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Description of the manner of Polishing and Silvering Plates for Looking Glasses, as practised in Paris.

[From the Journal Polytechnique.]

These plates of glass are cast at St. Gobin, because the materials of which they are composed, and the fuel necessary for melting them, are more conveniently procured there than at Paris. But, as it is necessary that a large quantity of these glasses should be kept at Paris, that being the place where there is the greatest demand, even for those which are intended for exportation into other countries, they are brought there in the rough. In that state, being more thick, they are less subject to be broken; and the inconvenience which would arise from their being scratched, or having the silver rubbed off, is also thereby avoided. If only a few were broken after being finished, (particularly if they were of a large size,) the loss would be more considerable than that occasioned by the breaking of a much greater number in their rough state; it being very difficult to finish them in a perfect manner, and keep them, at the same time, of their full size: those which are obtained in that state bear a very high price. Besides, in the magazine at Paris, to avoid unnecessary expense, they polish and silver only those plates for which orders are given.

For the reasons above mentioned, the plates are brought, in a rough state, from St. Gobin to Paris, both by land and water; and, to guard against accidents, they are placed on end, in a kind of wooden frame, leaning one against the other, and kept in at the bottom by a ridge, which admits within it the thickness of the plate.

These frames are suspended, by very elastic springs, on carriages, which are also hung upon springs. Between the plates are put, at certain distances, slips of elastic cloth, which prevent them from striking against each other.

When the glasses have been cast and annealed, (that is, cooled gradually,) they are pretty smooth (but by no means sufficiently so) on that side which lay against the plate of metal on which they were cast; on the other side they are rough and undulated: both surfaces are to be ground perfectly even. Before that operation is begun, they are examined, to see whether they have not some defects, such as deep cavities, or cracks, which might hinder their being polished in their original size. If any such defects are found, they are cut, by means of a diamond, in such a manner as to keep the plates as large as possible. If the line made by the diamond is near the edge of the plate, the part to be taken off is separated by blows with a hammer: if it is in the middle, the weight of the glass, acting as a lever, is sufficient for the purpose. If the glass was not what the workmen call well annealed,* it would not bear to be cut; but, when it is well annealed, it is more flexible, and less brittle, than is com-

* As the operation of annealing is very important, and the term itself improper, because it leads to false ideas of that operation, I shall here give some account of it. Annealing consists in cooling a body, which is dilated by heat, in a slow and progressive manner. To anneal plates of glass, they are put, immediately after being cast, and while yet soft, (upon the metal plate on which they were cast,) into a very hot oven, from which all flame and smoke are excluded, as they might tend to injure the colour of the glass. The fire is suffered to burn out gradually, and the plates grow cool, by degrees, as the fire abates. By this means, the contraction of the glass takes place very slowly, and equally in all directions. The particles of the glass approach nearer each other, and adhere together more strongly. If, on the contrary, the glass is suffered to cool in the open air, the following is the result. The glass, in melting, had increased in bulk; its surface, by being the first part cooled, and rather suddenly, preserves nearly the same dimensions. The internal particles, as soon as the heat which kept them at a distance from each other is entirely dissipated, are inclosed within a larger space, and consequently remain farther asunder: there is therefore a vacuum between these particles, and they tend to approach each other, both by their mutual attraction, and the pressure of the external air. For which reason, if this double effort is very strong, the glass splits, and breaks of itself; or, if the surface of the glass should be able to resist the effort, a very slight blow, or (what is more effectual) a trifling scratch upon its surface, is sufficient to break it. The first effect takes place when red-hot glass is dipped in water, or has water poured upon it. The drops of glass, called Dutch Tears, or Prince Rupert's Drops, furnish an example of the second kind. These drops are made by letting melted glass fall into water; as their surface is but small, and is of a spherical form, it is sufficiently strong to resist the expansion of the internal particles, and the pressure of the external air, caused by the vacuum which is formed within; but, if the end of the drop is broken off, the resistance ceases, and the glass drop, although very thick, is reduced into powder.

In some glass-houses, the workmen show glasses which have been cooled in the open air: on these they let leaden bullets fall, without breaking them. They afterwards desire you to let a few grains of sand fall on them; by doing which the glass is broken into a thousand pieces. The reason of this is, that the lead does not scratch the surface of the glass; whereas the sand, being sharp and angular, scratches it sufficiently to produce the effect here spoken of.

monly supposed. This is proved, not only by the operation just spoken of, but also by the following experiment of M. Buffon. He had a plate of glass fixed in a frame; over the middle of the plate was a screw, the end of which was covered with leather: by turning the screw, so as to press against the middle of the plate, he could produce therein a very evident degree of curvature.

First Operation.—When the plates have been examined, in the manner already described, the first operation is, to make them thinner. For this purpose, one, or more, is placed upon a very even table of stone, or of thick wood: on this they are fixed, in a truly horizontal position, by means of a layer of plaster in a rather liquid state. A workman gets upon the glass, and treads it, so as to force the plaster to spread itself evenly under the glass. Other plates, eighteen inches or two feet square, and also in the rough, are fixed, by means of plaster, upon flat pieces of wood or stone, of the same dimensions as the plates themselves: taking care (in order that the friction may not be too great) to place the smoothest side outwards, if the roughest side of the other plate is to be first polished, and *vice versa*. When the plaster is dry, these small plates are put upon the others; and, upon the flat stone, or piece of wood to which they are fixed, is laid another stone, for the purpose of increasing the pressure. This last stone is let into a frame of wood, which has a kind of handle at each corner: it may be made fast to the other by the help of a little plaster. Between the glasses is thrown water, mixed with sand, or with powdered grit stone, which should be finer as the work advances. The workman, by moving the machine about by means of the handles, (which he passes from one hand to the other,) grinds the plates, by rubbing them against each other, so that those which serve to polish the others become also polished themselves; but being much smaller in size than the under ones, they are much sooner ground smooth, and therefore require to be changed from time to time. At the beginning of the operation, as the surfaces are very irregular, the plates would be in danger of being broken by too great a degree of friction, if the machine were too much loaded; but, as the surfaces become more smooth, other flat stones, an inch and a half, or two inches thick, are put between those we have already described. The friction is of itself sufficient to keep them together; they may, however, have pieces of cloth between them. A kind of ruler, laid on the plates, serves to discover what parts are most prominent, and require rubbing down.

The operation here described is a partial one, and is performed, successively, in different parts of the plate, merely for the purpose of rendering it smooth: it must afterwards be made even.

Second Operation.—Two workmen, one at each end of the table, drive the machine from one to the other, making it turn about, upon the plate, in all directions. As the work advances, machines of the same form, but larger in size, are employed. The polishing of the plates might be entirely finished by means of these machines; but the one we are now going to describe answers the purpose much more completely.

Third Operation.—When the second operation (which lasts two or three days) is finished, the workmen (by means of plaster) fasten upon a kind of table (of the same size as the fixed one) a plate of glass, as large as that which is to be polished, and which has already been ground to the same degree of smoothness. This plate is laid upon the other, and to the wooden back or table is fixed a large and very light wheel, formed of a piece of thin wood bent into a circular form, and having a certain number of thin spokes, to which the rim is nailed. Between the wooden table and the wheel, square pieces of thin stone are gradually added, in order to increase the weight, as the glass becomes polished. Two workmen, by means of this wheel, push the table backwards and forwards, and cause it to turn about in all directions, taking care that water, with sand in it, is often thrown between the plates.* By this means, the two plates at last acquire a perfectly even surface. When they have thus been ground on both sides, in such a manner that the surfaces are exactly parallel to each other, (which is discovered by means of rulers and proper levels,) they are not yet transparent, but have a whitish dull appearance on the surface, occasioned by an infinite number of little scratches made by the sand. They must still undergo other operations, which we shall now describe.

[TO BE CONCLUDED IN OUR NEXT.]

An account of the several Compositions of Metals and semi-Metals, on which trials were made, to find out the most proper mixture for the Specula of Reflecting Telescopes. By the Rev. JOHN EDWARDS, B. A.

[Forming the appendix to his paper upon Speculums.]

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THE immense labour performed by Mr. Edwards in order to ascertain the best mixture for speculums, will appear from the results here given; these, however, form only a part of his experiments, the whole number of trials exceeding one hundred; but the compound No. 47, was far superior to either of the others. Although the greater number of the mixtures were found to be useless, the publication of them is not thought so, as it will prevent the performance of fruitless experiments by others.

After the publication of the directions already given, Mr. Edwards, in a letter to Dr. Maskelyne, gives the following additional precautions:—

"Make the brilliant composition first of copper and tin. Melt

* We have observed, at those parts where the sand with which the glass is polished falls, very considerable efflorescences; they had the appearance and the taste of barilla. We believe that the glass (which is composed of barilla and sand) is decomposed, by the extreme division of its parts, and the heat occasioned by the friction made use of.

the proportional quantity of silver and brass in a small crucible by itself. When you put the brilliant composition the second time into the crucible, add also the lump of brass and silver melted together before in a separate crucible; and when the whole is now fluid, add the proportional quantity of arsenic, and then pour it off into the flasks, after the scoria is taken off, and a little powdered rosin is thrown into it."

1. Copper and grain-tin, equal parts; very bad, soft, and of a blue colour.
2. Copper with arsenic $\frac{1}{8}$; but little different from the first.
3. Tin 2, copper 1; much worse than the preceding ones.
4. Copper 32, tin 16, arsenic 4, fixed with nitre; black and brittle.
5. Copper 6, tin $1\frac{3}{4}$, arsenic 1; very indifferent.
6. Copper 32, tin 14, arsenic 2; a very good metal.
7. Copper 32, tin $13\frac{1}{2}$, arsenic 1; not quite so good as the sixth.
8. Copper 32, tin $13\frac{1}{2}$, arsenic $1\frac{1}{2}$; a good metal.
9. Copper 32, tin 15, arsenic 2; much better than any of the above.
10. Copper 6, tin 2, arsenic 1; compact, but very yellow when polished.
11. Copper 3, tin $1\frac{1}{4}$; compact, and whiter than the tenth.
12. Copper 32, tin $14\frac{1}{2}$; a pretty good metal, but polishes too yellow.
13. Copper 32, tin 15, arsenic 2, flint glass, in powder, 3; very bright, but rotten.
14. Brass 6, tin 1; compact, but too yellow.
15. Two parts of the eleventh composition, and one part of the fourteenth composition; compact, but much too yellow when polished.
16. Brass 5, tin 1; somewhat whiter than the fourteenth.
17. Brass 4, tin 1; a good metal, but rather yellow.
18. Brass 4, tin 1, with arsenic $\frac{1}{10}$; whiter than the seventeenth.
19. Brass 3, tin 1; will not polish well.
20. Brass 2, tin 1; of a sparry nature.
21. Tin 3, brass 1; too soft, being only a kind of hard pewter.
22. Brass and arsenic, equal parts; a dirty white colour.
23. Brass, copper and arsenic, equal parts; a dingy white.
24. Brass and platina, equal parts; very difficult to fuse and mix well together, is then malleable, and of a dingy white colour, like the twenty-second composition.
25. Copper 32, tin 14, crude antimony 4; black and rotten.
26. Copper 32, tin 14, crude antimony 1; bluish, and rough-grained.
27. Copper 32, tin 15, arsenic 4, bismuth 2; much too rotten.
28. Copper 32, tin 15, arsenic 3, bismuth 1; much too yellow when polished, and appears also porous.
29. Copper 2, zinc 1; a pale malleable metal.
30. Copper and zinc, equal parts; still malleable and rough-grained.
31. Copper 32, tin 15, arsenic 4, zinc 4; a good metal, but does not take a high lustre.

32. The thirty-first composition fluxed with corrosive sublimate; a compact and hard metal, but rather yellow when polished.

33. Copper 32, tin 16; a most beautiful brilliant composition, but much too brittle and rotten.

34. Copper 32, tin 17; bluish and rough-grained.

35. Copper 32, tin 18; bluish and rough-grained.

36. Brass 2, zinc 1; nearly of a gold colour.

37. Brass and zinc, equal parts; a pale gold colour, and rough-grained.

38. Spelter 4, tin 1; very rotten.

39. Copper and crude antimony, equal parts; of a sparry nature.

40. Copper 32, tin 15, arsenic $\frac{1}{4}$th of the whole; a very beautiful and brilliant metal, but tarnishes when exposed for some time to the air.

41. Silver and bismuth, equal parts; a yellowish-white metal, and not much harder than silver itself.

42. Silver and tin, equal parts; a white metal, almost like silver itself, and much too soft for specula.

43. Silver, tin, and bismuth, equal parts; a dingy white colour, but much harder than the two preceding compositions.

44. Copper 32, tin 15, silver 1; a beautiful compact metal, but polishes rather too yellow.

45. Copper 32, tin 15, silver 2; not so white as the preceding.

46. Copper 32, tin 16, brass 4, arsenic 2; rather too much tin, as the composition was of a bluish complexion, and rough-grained.

47. Copper 32, tin 15, brass 1, silver 1, arsenic 1; a most excellent metal, being by much the whitest, hardest, and the most reflective I have ever yet met with.

48. Common bell-metal; polishes very yellow.

49. Common bell-metal 4, regulus of antimony 1; bluish and rough-grained.

50. Common bell-metal 6, regulus of antimony 1; still bluish and rough-grained.

51. Copper 32, tin 14, regulus of antimony $1\frac{1}{6}$, *viz.* 1 oz. to 1 lb.; too much antimony, it being of a bluish colour, and rough-grained.

52. Copper 32, tin 13, regulus of antimony $\frac{1}{16}$; bluish and rough.

53. Copper 32, tin 13, regulus of antimony $\frac{1}{32}$, *viz.* 1 oz. to 2 lbs.; a very fine metal, in appearance like thirty-three.

54. Copper 32, tin 13, regulus of antimony $\frac{1}{40}$, *viz.* 1 oz. to $2\frac{1}{2}$ lbs.; a beautiful metal, not much unlike forty-seven, but not quite so white.

55. Crude antimony 16, cawk-stone 1 or 2 oz.; a very bright glassy metal, like the common vitrum antimonii, but by no means fit for mirrors.

56. Copper 32, tin 16, vitrum antimonii, made from the cawk-stone 1 oz.; a very indifferent composition, as the vitrum antimonii did not differ in its effects from crude antimony.

57. Copper 32, tin 14, lead 2; no art can make this composition mix intimately, as the lead will always separate from the copper and tin.

58. Copper 32, tin 16, regulus of antimony 3; black, and much too rotten.

59. Copper 32, tin 16, iron-filings 8; a bluish-gray colour, and rough-grained, and appeared somewhat like steel when broken through.

60. Fifty-ninth composition 8 oz., tin 1 oz.; a little whiter than the fifty-ninth, but still too blue.

61. Equal parts of fifty-nine and sixty; still of too blue a colour, and not close-grained.

62. Copper 32, tin 16, arsenic 3, iron-filings $\frac{1}{4}$ of an oz.; a pretty brilliant composition, but much inferior to forty-seven.

63. Platina 1 oz., brass 1 oz., cawk-stone red-hot $\frac{1}{2}$ oz.; excessively difficult to fuse, and of a dirty light brown colour, and somewhat malleable.

64. Copper 32, tin 16, iron-filings 4, regulus of antimony 4, and fluxed with corrosive sublimate; an exceeding hard and compact metal, but of too blue a colour.

65. Copper 2 oz., tin 1 oz., iron-filings 1 dr., regulus of antimony 1 dr.; too blue a colour, and rough-grained.

66. Regulus of antimony and tin, equal parts; sparry, and not fit for mirrors.

67. Cast-steel; will not polish upon pitch, either with putty, or colcothar of vitriol.

68. Steel 1, tin $\frac{1}{4}$; very rough-grained and bluish, and not much different from steel itself.

69. Steel 1, tin 1; rough-grained, and of a bluish colour.

70. Steel 1, and forty-seventh composition 20 parts; rough-grained, and not near so good as forty-seven.

71. Steel 1, and forty-seventh composition 30; not much different from the forty-seventh composition, but not so beautiful and close-grained.

Abstract of Poppe's History of Clock and Watch making, and of the Method of Dividing the Day at different Periods of Time.

The oldest Method of Dividing the Day, and the Invention of Sun Dials.

The period when, is as little known as the country where, and the person by whom, sun-dials were invented. M. Poppe, however, has collected from the oldest authors what is to be found on the subject, and examined it with critical accuracy. The earliest account of instruments destined to mark the lapse of time by the sun's shadow is to be found in the Bible and in Homer. A sun-dial constructed according to the description of Vitruvius, was found in the year 1741, among the ruins of a villa on the Tusculan hill at Rome. A sun-dial of the same kind is still to be seen at Athens, standing

on the summit of a rock, to the right of an edifice built by Thrasyllus.

Use of Sun Dials, and the Division of the day into Hours, among different ancient nations; gradual improvement of the art of constructing and using them, to the present period.

The Indians, Siamese, Tartars, Persians, Chaldeans, Egyptians, and Chinese divided the day into 60 hours, and each hour into 60 minutes, &c. These people, even employed a gnomon for the purpose of placing their temples according to the principal quarters of the globe. We know from history that the Chinese made use of gnomons 12 or 15 centuries perhaps before the birth of Christ. The old geographers, by examining the length of the shadows of gnomons of equal height, determined the latitude of places, and the obliquity of the ecliptic. Berosus brought to Greece from Asia, the first sun-dial, and the division of the day into twelve hours; Anaximander, about six centuries before Christ, made an improvement in sun-dials, as did also Anaximenes. Eudoxus, four centuries before Christ, constructed a still more perfect sun-dial, under the name of *arachne*. Apollonius of Perga, about a century before Christ, invented the *pharetra*. Patrocles found out the *pelekinon*, Dionysiodorus the sun-dial in the form of a cone, Cleanthes the hemisphere or *scaph*, Parmenio the *prostapistorumena*, Theodosius and Andreas the *prospanklima*. Vitruvius makes mention of three other sun-dials, *gonarcha*, *engenaton*, and *antiboreum*, without describing them or naming their inventors. The author describes all these sun-dials, with as much precision as the accounts of them remaining will allow, and with literary and technical accuracy. There were public sun-dials both at Athens and Sparta. Eratosthenes and Archimedes, employed dials very accurately divided for astronomical purposes; and all the cities of Greece of any consideration soon had public instruments of this kind. Ring-dials soon began also to be used. A dial of this kind was suspended in the large ship of Hiero; but the Grecian navigators, for measuring the state of the sun, the time of the day, and the stars above the horizon, employed rather the hodometer described by Vitruvius, which seems to have furnished the first hint for our measurers of time, constructed with wheel-work. It was very late before the Romans had real sun-dials. They employed in their stead obelisks, to which good gnomons were applied. The largest of all the gnomons of modern times, was that of Ulug Beigh, erected at Constantinople in the 15th century, which was 183 feet in height. The Bononian obelisk, 83 feet high, erected by Cassini, that of Paris, and the one which Pope Clement XI. caused to be constructed, are also celebrated. In the ancient gnomons, the hours were indicated by the shadow of a style; in the modern ones the same thing is done by the sun's rays passing through a hole. The Greeks and Romans employed persons of both sexes, to announce to them the hours, as indicated by the public gnomons. Trimalchio caused the hours to be announced to him by a trumpeter.

This was afterwards customary at the temples. It is not known, however, when portable sun-dials came into use. Some of these instruments, after being buried more than 15 hundred years, were found between 1730 and 1740, in the territories of Rome: of these remains of antiquity the history gives a description. That Purbach, an astronomer of Vienna, introduced sun-dials into Germany about 300 years ago is not probable, as the Germans, no doubt, obtained them by their intercourse with the Romans. In the 16th century, artists took great pains to construct sun-dials, in a great many ingenious ways; about the same period, lunar and astral dials were invented. There is a sun-dial at Besançon which is seen only when the sun shines. This M. Poppe describes, as well as the dial below the roof of the council-house at Ingoldstadt. Another at Alençon, still more ingenious, is connected with wheel-work, and indicates true and mean time. In the museum at Göttingen there is a collection of sun-dials, and other works of art of a similar kind, preserved in a box.

Oldest Method of Dividing the Night. Invention of water-clocks and sand-glasses, and the progressive improvement of them to the present time.

The circumstance of sun-dials being of no use in the night time, and during cloudy weather, gave occasion to the invention and improvement of water-clocks; traces of which may be found among the oldest nations, the Chaldeans and Egyptians. They were in use also at an early period among the Chinese. They were employed by the Egyptian astronomers, for measuring the diameter of the sun. In their first state, they were called *clepsydræ*, because the water issued from them drop by drop. The defect, in regard to the inequality in the efflux, was at first remedied by the small stick of the Indians, having a hole bored in it, and which floats some time on the water, but which, after a certain period, discovered by repeated trial, becomes immersed. It was afterwards contrived to keep the water-clock always full, by suffering the same quantity of water to run in, as that which flowed out, that equal portions of time might be indicated by an equal fall. A funnel, or inverted pyramid was then employed, in which the water descended in unequal parts, but through equal degrees marked out on a scale. In the course of time, the knowledge of astronomy was applied to these clocks, and some were constructed in a very ingenious manner: of this kind was the *anaphoricum*, which the author describes; also the retrograding clock, and winter water-clock. Plato brought the first water-clock to Greece. The first that ever appeared at Rome, was shown by Scipio Nasica, about the year 157 before Christ: but soon after, these clocks were common, not only at Rome, but in other towns of the Roman empire. When Julius Cæsar invaded Britain, he found that the inhabitants had water-clocks. In general, they were more prized than sun-dials. Athenæus constructed a clock, which indicated the hours, by the hissing noise of the air forced through a

narrow hole, by the pressure of water. Together with public sun-dials, public water-clocks were also soon introduced. These were established even in the palaces of the great. That the hours as announced by these water-clocks, may be more easily made known to the public, the Turks have criers posted on high towers,—and the Chinese, persons who strike on large bells. The Japanese employ burning matches to indicate the time, and announce the hours in the same manner as the Chinese. The use which Hipparchus and Ptolemy made of water-clocks, contributed to their improvement: they were much improved by Hero, but during the next seven centuries, nothing was done in this respect. The clocks of Boethius, that which Harun al Raschid sent as a present to Charlemagne, and that of the philosopher Leo of Constantinople, were much celebrated, though the invention of clocks with wheel-work, rendered water-clocks unnecessary. The latter, however, continued some time after in use; and about the year 1660, water-clocks in the form of a drum, which are those called properly at present water-clocks, were invented it is probable in Italy, but rather for curiosity than for real use. The observation that the water soon evaporated, may have given occasion to sand being used in such clocks, instead of water. The period when this change was made is not known. There is reason only to conjecture, that the Egyptians and Chaldeans had hour glasses. In the Monachal Laws, the word *klepsammidia* occurs only in writings of the eighth century; and it was not till a much later period, that attempts were made to construct hour glasses, in an elegant and ingenious manner. Many of them are described by Francis de Lanis, as well as by Schott and Ozanam. Rivault employed such sand glasses for astronomical observations; and likewise Tycho Brahe, who used also clocks constructed with quicksilver.

Ingenious water-clocks and other machines, the moving principle of which was different from that of our common Clocks, that go by wheel-work.

Under this head, the history speaks of the machine which king Gonebaud received as a present from Theodoric, king of the Goths. It gives also a description of the before-mentioned clock, sent by Harun al Raschid to Charlemagne. At that period, the eastern princes presented clocks to the western; at present, this mode is reversed. Some other ingenious clocks, from Schott, Kircher, Ozanam, Martinelli, and de Lanis; also Perrault's pendulum-clock, which was moved by water, and a Chinese one, which Y-Hang caused to be constructed, belong also to this class.

[TO BE CONTINUED.]

Process for Dying Nankeen colour. By Mr. Richard Brewer.

Mix as much sheep's dung in clear water, as will make it appear of the colour of grass, and dissolve in clear water one pound of best

white soap, for every ten pounds of cotton-yarn, or in that proportion for a greater or lesser quantity.

Observe:—The tubs, boards, and poles, that are used in the following operations must be made of deal; the boiling-pan of either iron or copper.

First Operation.

Pour the soap liquor, prepared as above, into the boiling-pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan, as will be sufficient to boil the yarn, intended to be dyed, for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat, regularly, during that period. Continue it boiling for three hours, then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B. The cotton yarn, when in the shed, should not be exposed either to the rain or sun: if it is, it will be unequally coloured, when dyed.

Second Operation.

In this operation, use only one half of the soap that was used in the last, and as much dung liquor, (strained as before directed,) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors, are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it without washing, and hang it to dry as in the former operation.

Third Operation.

This operation the same as the second, in every respect.

Fourth Operation.

For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling-pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry as in former operations.

N. B. This operation is to cleanse the yarn, from any oleaginous matter that may remain in it after boiling in the soap, and dung liquors.

Fifth Operation.

To every gallon of iron liquor* add half a pound of ruddle, or red chalk, (the last the best,) well pulverized.

* Iron liquor is what the linen printers use.

Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling-pan, and bring it to such a degree of heat as a person can well bear his hand in it; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it, and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clear board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour: this done, it must be hung to dry as in former operations.

N. B. Any degree of red or yellow hue may be given to the yarn, by increasing or diminishing the quantity of ruddle or red chalk.

Sixth Operation.

For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling-pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn, when the liquor is a little warm; observe to keep it constantly under the liquor, for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry, as in former operations.

Seventh Operation.

Make a sour liquor of oil of vitriol and water; the degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well, and wring it; give it a second washing and wringing, and lay it on a board.

N. B. This operation is to dissolve the metallic particles, and remove the ferruginous matter that remains on the surface of the thread after the fifth operation.

Eighth Operation.

For every ten pounds of yarn, dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling-pan, as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water, very well, and hang it to dry, as in former operations: when dry, it is ready for the weaver.

N. B. It appears to me, from experiments, that I have made, that less than four operations in the preparation of the yarn, will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent.

Instructions for making Red Crayons. By A. F. Lomet.

It is not without difficulty, that crayons of a good quality can be obtained for drawing schools, particularly at a distance from the metropolis. The native ochre sawed into pieces, which are commonly used, is almost always hard and of an uneven and gravelly consistence; so that the outlines in drawing, for which it is used, cannot be made either with the softness or the precision requisite to produce the desired effect. The only good crayons that can be procured have been hitherto manufactured in Paris exclusively, where they have been long sold at a very high price. The best are known by the name of crayons *de pâte du Desmarest*, who was probably the inventor. None of those who have written on the composition of those crayons, have mentioned the quantity of ingredients which ought to be employed. I have made a series of experiments on all the combinations possible to be made, with the substances proper for that fabrication. I have rejected those products that have not answered the purpose of my inquiries, and I here offer those processes which have afforded satisfactory results.

These crayons are composed of soft ochre, which is an oxide or bog ore of iron, containing a mixture of earth, of the nature of the clays, which we call hematite. They incorporate it with some binding substance, such as lime, glue, or rosin, mixed sometimes with soap, to take off the hardness of the composition. Instead of the ochre, called Sanguine in French, the other ochres, such as those known by the name of brown-red, or colcothar of vitriol, may be used. In this case, it is necessary to choose them soft to the touch, and of a lively colour, those that are intended for sale, being often mixed with clay; which gives them a yellowish and dull colour, and ought consequently to be avoided.

I have made the experiment of incorporating those substances with the white of eggs and the albumen of the blood; but the crayons were not of a good quality. The softest ochre should be taken, and ground with pure water on a marble, as practised with the colours used for painting, observing to moisten it no more than may be absolutely necessary, to facilitate the sliding of the mullar.

When the operation of grinding in the large way becomes difficult, and too expensive, another method may be practised, to divide the colouring matters. After pounding, they are sifted through a silk sieve, then diluted with much water, in tubs, and after strong agitation, left to settle for a few minutes; that is to say, for the time, sufficient to suffer the coarsest particles to fall to the bottom. The water highly charged with the finest parts, is then drawn off, and left to settle for four and twenty hours, when the clear water is also decanted off. A very fine powder is thus obtained. The coarse remainder is to be ground and treated in the same manner, till the whole mass be reduced to a state of extreme division.

The gum, the glue, or the soap intended to give a sufficient degree of solidity to the crayons, are to be separately dissolved, and

the solutions worked up with the grinded ochre. The mixture is then dried by exposing it to the sun, or before a fire by a very moderate heat, taking care to stir it often, till the paste has acquired the consistence of butter.

The crayons are then to be fashioned or moulded, which may be done in two ways. The first consists in spreading the paste upon a board, in which a number of channels or half round grooves are made, of an indeterminate length, but of a depth and width proportioned to the size of the crayons intended to be manufactured. The second method, which is the best, consists in pressing the paste through the pipe of a syringe, whose orifice is equal to the size of these crayons. The pieces when moulded in this manner, are left to dry. This desiccation ought to be performed slowly, and in the shade, to prevent cracks, which would be formed, if this precaution were not attended to.

When the pieces are dried, they are to be divided into lengths of two inches (or five centimetres) each; the edges are rounded off, and they are roughly pointed. They must then be scraped, to remove a hard external surface which they acquire during their drying, and would prevent their marking.

A slight coating of oil must be smeared over the wooden moulds, to prevent the paste from adhering to the sides.

Gum arabic and isinglass are to be preferably used. The gum and soap may be dissolved in water; but the isinglass must be first cut into small pieces, afterwards put into warm water, and dissolved on a water-bath. These solutions must be sufficiently liquid to pass through a hair-sieve, and leave their impurities behind.

It is not without difficulty that the paste incorporates with the solution of glue. Both must be warm, and the mixture must be made over the fire at the boiling water heat.

The paste must be well mixed together before it is put into the moulds, in order that it may be uniformly incorporated with the solution, and leave no hard parts. It would be better to work it with the painter's mullar, and to grind it for a short time on the stone, before it is put into the moulds.

It is only in the crayons, which contain gum, that soap can be admitted. None of the experiments in which glue and soap have been used together, have ever succeeded; and it must be so, because the excess of the alkali of the soap acting on the gelatine destroys its adhesive quality.

As those crayons, into the corporation of which soap enters, are found to afford a darker shade, it seems that this combination takes a portion of the oxygen from the red oxide of iron, and renders it brown by bringing it nearer to the state of the martial ethiops. I have observed that all the pastes prepared with the oxide of iron, even if with mere water, become brown on their exterior surface during the drying. This effect takes place in a more evident manner, when they are exposed to the sun; and it appears to arise from the light taking a portion of the oxygen from the oxide of iron. I shall hereafter return to the chemical properties of these kinds of pre-

parations, but my present purpose is only to describe those processes of fabrication in which I have constantly succeeded, in order that they may be repeated with success.

The crayons composed after these directions have all the good qualities which can be required; they do not cost one-fourth of the price of those in the shops; but it must be noticed that their composition requires great exactness in the quantity prescribed, because the least alteration, occasions a considerable difference in the quality of the paste. It is particularly necessary to guard against those errors which may happen from inevitable diminution, during the time of the manipulation. The best way to prevent this, will be to ascertain by experiments, the quantity of water and ground ochre which these solutions may contain before mixing them.

By means of the quantities stated in the following table for each of those kinds of crayons, it will be easy to know the proportional quantities of gum, glue, or soap, which may be employed for a determinate weight of ochre or red oxide of iron.

Substances to be employed, with their quantities and results.

No. 1.		These crayons are very friable, but they may be used for large drawings. These contain the least possible quantity of gum. If less be used they will not have sufficient consistence to be of any use.
Dry ochre, or red oxide of iron	10. gram.	
Dry gum arabic	1.311 gram.	
No. 2.		
Ochre, &c.	10. gram.	Soft crayons, rather friable, and excellent for large drawings.
Gum,	0.363 gram.	
No. 3.		
Ochre,	10. gram.	Smooth and solid crayons, fit for common use.
Gum,	0.415 gram.	
Or still better, with	0.441 gram.	
No. 4.		
Ochre,	10. gram.	Soft firm crayons, for drawings which require delicacy and precision.
Gum,	0.467 gram.	
No. 5.		
Ochre,	10. gram.	Very firm crayons, fit for small drawings, which require to be highly finished.
Gum,	0.519 gram.	
No. 6.		
Ochre,	10. gram.	Crayons almost too hard to be used. This is the maximum of gum that can be employed in their composition.
Gum,	0.571 gram.	

No. 7.

Ochre,	10. gram.	These crayons are of a darker colour than the others mentioned; they are of a very hard consistence, and soft to the touch; but all crayons into whose composition any soap enters, have the defect of making strokes which shine too much when retouched. None of my experiments with soap succeeded. These crayons very much resemble those of the composition of *Desmarest*.
Gum,	0.380 gram.	
White dried soap,	0.519 gram.	

On various Compositions for Blacking and Polishing Leather.

Various compositions are used to give a sort of polish or varnish to leather, by being brushed over it. The blacking that has been most generally used for some years past, in France, was composed of the whites of eggs, beaten up with water; to which were added a little lampblack, to colour it; and some sugar, or gum, to render it shining. It was sufficient to spread this mixture over the leather with a brush, and allow it to dry.

This blacking is very beautiful, and easy to be made and used; but it has its inconveniences: it is not very solid; heat causes it to scale off; and it is dissolved by the least quantity of water that touches it. Humidity alone, is sufficient to cause it to come off, on the least friction. It is now but little used in large towns, as the following superior composition is substituted for it; viz.

Ivory Black,	3500 grammes.*
Molasses,	3500
Sulphuric Acid,	450
Hydrochloric or Muriatic Acid,	450
Weak Acetic Acid,	1700
Gum Arabic,	200
Linseed or Olive Oil,	200
	10,200

The sulphuric acid, is diluted with six times its weight of water, which must be mixed with some precaution, adding it by degrees, that the temperature may not be too rapidly raised, or there is great risk of breaking the vessel. A mixture is then made of this diluted acid, with the hydrochloric acid and molasses, in a large earthen vessel. The ivory black, previously mixed with a sufficient quantity of water, to make it of a moderately thick consistence, is then added by degrees to the acidulous liquid, stirring it all the while, not only for the purpose of disengaging the gas which is generated, but also to prevent the mixture from forming into a mass, or coagulating. When the mixture is well blended together, it is diluted with weak acetic acid, or common vinegar; and the gum, previously dissolved

* The gramme is nearly equal to 15½ English grains.

in four or five times its weight of water, is then added, with the oil. The whole is then again well stirred together; and, finally, a sufficient quantity of water is added, to increase its volume to 17½ litres,* which will produce 70 bottles of blacking, of a quarter of a litre each. This blacking is sometimes scented with an essential oil, such as that of rosemary, &c.

The mixture must be constantly agitated, while putting into the bottles, in order that the heavier and lighter parts may not separate from each other. This blacking, when it is sent to any great distance, or remains long in the shops, is susceptible of entering into fermentation; and the great quantity of carbonic acid formed, during the conversion of the saccharine matter (the molasses) into alcohol, exerts a pressure in the bottles, and renders them liable to burst; or, when the cork is drawn, to occasion the effervescing liquid to fly out: to prevent which, it is sufficient to cause the corked bottles to be boiled in water for half an hour, in M. Appert's mode; but it is probable that the same end may be accomplished by mixing a small quantity of the sulphurous acid with the blacking. Whenever the blacking is to be used, it must also be shaken or stirred up, in order to mix those parts again, which are apt to separate on standing.

This composition is effected by the re-actions of the sulphurous and hydrochloric acids upon the *ivory-black;* also by the hydrochlorate, the sulphate and the phosphate of lime formed; the carbon, and the other ingredients employed in its preparation, sustaining very little alteration from their mixture. This composition being spread upon the leather, and rubbed over, while it is wet, with a rather hard brush, makes it acquire a beautiful, brilliant, and black polish; it adheres closely to the leather, and is not removed by any slight friction, not even in damp weather. The hydrochloric or muriatic acid, which is employed in an equal quantity with the sulphuric; or is about a third part of all the acids used in the composition, forms with the lime a soluble deliquescent salt, which enters, and gives a softness to, the leather, and does not produce that dull appearance which results from an excess of the sulphate of lime.

This article forms a very important branch of commerce in England; considerable quantities of it being exported; and, in the large manufactories, steam-engines are employed in its preparation.

Some years since, I pointed out a more economical mode of making a blacking, which is yet equally beautiful with the above: it consists in substituting for the molasses and gum, either the fecula of potatoes, or the potatoes themselves, saccharized by the action of the sulphuric acid; and for the *ivory-black*, animal or bone charcoal, ground in water. It is made in the following manner: supposing all the ingredients, except those substituted, to be used in exactly the same proportions as we have above given.

Either the fecula, or the potatoes, after being boiled and crushed, so as to be reduced to a gelatinous state, are to be mixed with tepid water (at about 45°;) and sulphuric acid, previously diluted with

* The litre is nearly equal to 2¼ wine pints.

ten times its weight of water, is then poured on it by degrees, and the whole brought to a boiling heat in a leaden vessel; being careful to keep the acid mixture and the fecula, or potatoes, well stirred together, and to make the additions in such small quantities, as to interrupt the ebullition as little as possible. Two or three minutes after the last addition has been made, the starch is completely saccharized; the vessel must then be taken off the fire; without which precaution the saccharine matter would very soon become scorched. The mixture is then allowed to cool gently, and during this time the hydrochloric acid is poured upon the animal charcoal by small portions at a time, and stirred with a wooden spatula; and this part of the process is finished, by mixing this charcoal in the saccharine liquid and acid, when the sulphuric acid acts with as much energy as in the former process.

This mixture is then boiled to a rather thick consistence, and is passed through a colour-mill. The mill is previously washed, by throwing into the hopper the remainder of the acid liquid or vinegar, and then pure water; and these washings are put into the blacking; finally, the other ingredients are added, together with a sufficient quantity of water, to increase its volume to 17 litres and a half, as in the former process.

The blacking thus obtained is absolutely the same as the other: the fineness of the black, which enters into the composition, is even more equal.

We also find, in commerce, many other kinds of blacking, formed of resins, gum-lac, spirit of wine (alcohol,) lamp-black, ivory-black, and other substances, in great number, and in various proportions; but they are very little used.

P.

[*Dictionnaire Technologique.*

A cheap and efficacious Method for Destroying Rats and Mice; recommended to the Agriculture Society of Manchester. *By* Mr. C. Taylor.

In, or near the places frequented by these vermin, place upon a slate or tile, one or two meat spoonfuls of dry oat meal; lay it thin, and press it flat, that you may more easily know what is taken away. The rats, if not interrupted, will come regularly to feed there; supply them thus with fresh oatmeal for two or three days; then, to about six spoonfuls of dry oatmeal, add three drops of oil of aniseeds; and having stirred the mixture well together, feed them with this for two or three days more; then for one day give them only half the quantity they have usually eaten of this scented oatmeal, and on the following day, place the following mixture:

To four ounces of dry oatmeal, scented with six drops of oil of aniseeds, add half an ounce of carbonate of barytes, previously pounded very fine in a mortar, and sifted through a little fine muslin or cambric: mix this intimately with the scented oatmeal, and lay

this mixture of oatmeal and barytes upon the tile or slate, as the oatmeal had been usually placed, and allow the rats to come and eat of it for twenty four hours, without interruption.

A few hours after eating thereof, you will frequently see some of them running about as if drunk, or paralytic, but eventually, they generally all retire to their haunts and die. As rats are extremely sagacious, it may be proper, where they have only eaten a small portion, to allow the mixture to remain for forty-eight hours. It will be best to burn what is left after that time, as a fresh mixture may be prepared at a trifling expense, when wanted.

During the time in which the mixture of barytes is exposed to the rats, it is necessary to keep shut the doors of the places where it is laid, to prevent the vermin from being disturbed, or a possibility of accident to any other animal or person; for though it is not so extremely dangerous, if taken internally, as the preparations commonly employed for killing rats, and is even in some cases used in medicine, yet it is fatal if taken improperly.

The oil of aniseeds renders the mixture disagreeable to dogs, and many other animals, but is, in small quantities, alluring to rats.

Carbonate of barytes, is tasteless, semi-transparent, and effervesces with acids: it is moderately hard and striated. It is frequently called aerated barytes (*terra ponderosa aerata,*) and sometimes, by the miners, ponderous spar.

ON GILDING.

On the Preparation of Gold, and the art of Gilding in size, oil, &c.

We have already given a description of the mode pursued in France, in the various kinds of gilding upon metals, wood, and other substances, and now present a view of the English practice, in some of the processes of this art, as given in Gill's Technical Repository.

The art of *gilding*, or laying a thin superficial coating of gold, on wood, and other substances, has been long practised and highly esteemed, both for its utility and the splendid effect which it produces. Gold, from its great beauty, and from the length of time, during which it may be exposed to the action of the air, without tarnishing, is unquestionably the most valuable of all substances, for the purposes of decoration: but, on account of its great price and weight, it can only be used for general purposes, in the shape of a thin skin, or leaf, as it is usually called. Gold is the most malleable and ductile of all substances; and therefore, a given weight of it, notwithstanding its high specific gravity, may, by beating, be made to cover a larger surface than an equal quantity of any other body whatever.

The different states in which gold is used, for the purposes of gilding, are the following: first, in the shape of leaf gold of different

degrees of thickness, and formed either of the pure metal, or of alloy of this with silver: second, as an amalgam of gold; and, third, in gold powder.

OF LEAF GOLD.

The leaf gold is procured by the gilder, from the gold-beater, whose art consists in hammering a number of thin rolled plates of the metal between skins, or animal membranes.

OF GOLD AMALGAM.

The amalgam of gold is made by heating in a crucible some pure quicksilver; and, when it is nearly in the boiling state, about the sixth part of its weight of fine gold in thin plates, heated red hot, is to be immersed in it. The mixture soon becomes homogeneous; and then it is allowed to cool. When cold, it is to be put in a piece of soft leather; and, by gradual pressure, the fluid part of the amalgam, consisting almost wholly of mercury, may be forced through the pores of the leather; while the gold, combined with about twice its weight of mercury, will remain behind, forming a mass, of the consistence of butter. This, after being bruised and ground in a mortar, or shaken in a strong phial, with repeated portions of salt and water, till the water comes away quite clear and unsoiled, is fit for use; and may be kept for any length of time, without injuring, in a corked phial.

It is of the utmost importance, that the materials of the amalgam, and especially the mercury, should be perfectly pure; as the least portion of lead or bismuth, would very materially injure the beauty of the gilding, by deteriorating the colour of the gold, and filling it with black specks.

OF GOLD POWDER.

Gold in powder is prepared by three different methods: the first and most simple is, to put into a glass or earthenware mortar, some gold leaf, with a little honey, or thick gum-water,* and to grind the mixture for a considerable time, till the gold is reduced to extremely minute fragments: when this is done, the honey or gum-water may be washed away, leaving the gold behind, in a minute pulverulent state. A more effectual and quicker method of reducing gold to a state of powder, is, to dissolve it in *aqua Regia*, or, as it is denominated in the new chemistry, in nitro-muriatic acid, and then precipitate it with a piece of copper. The precipitate, after being digested in distilled vinegar, and then washed with pure water and dried, is in the form of a very fine powder; and is said to work

* Loaf-sugar ground in the dry state with the leaf gold, and afterwards separated by washing, is preferred by some; we have used common molasses, and have not seen reason to wish for a better article. A large quantity of water must, in any case, be used in the washing. EDITOR.

better, and is fitter for burnishing, than the powder obtained from leaf-gold. The very finest ground gold is produced by heating gradually the gold amalgam, already described, in an open earthen vessel, and continuing it over the fire till the whole of the mercury is evaporated; taking care that the amalgam shall be constantly stirred with a rod of glass, to prevent the gold from adhering in lumps, as the mercury flies off. When the mercury is completely evaporated, the residual gold, being then ground in a Wedgewood-ware mortar, with a little water, and afterwards dried, is fit for use.

Gilding is performed either with or without heat. By the first of these methods, those substances are gilt which are not liable to alteration, by exposure to a moderate heat; such as, metals, glass, and porcelain. The second method is practised with those substances, as wood, paper, lead, &c., which would be destroyed by being raised to a temperature requisite for gilding the former. Our business is chiefly with wood.

Gilding on wood, both in oil and varnish, is at present in its highest perfection, and is executed in London better than in any other part of the world. That which is brought from France, and other parts of the continent, is by no means equal to it: not that it is to be inferred, from hence, that gilding is well executed by all who undertake it in the metropolis. Many men, who have worked there all their lives, are unable to gild properly a common picture-frame, though they get employment. It is however hoped, a better judgment will be formed from the instructions here given; from which it has been known, that a person bred a cabinet-maker, and who never saw gilding performed, has accomplished the work in the best style, in the course of six months' practice.

BURNISHED GILDING ON WOOD.

To begin with picture-frames, or mouldings, which are the simplest works performed in this branch.—Put into an earthen pan, that will hold a quart, three half pints of strong size, the composition of which will be described hereafter: make it very hot over the fire, but do not let it boil: add some of the best whiting, powdered fine; mix them with a brush kept for the purpose, or beat them up with a piece of lath, &c. as an egg is beaten, till they become thoroughly incorporated, and of the consistence of thick cream: put a little of this mixture, with an equal quantity of strong size, into a smaller pan; heat it till near boiling; and, with a stiff brush, lay it over the whole work, in order to clear away any dirt, grease, or hand marks: this is called *thin-whitening* the work, and makes a ground for the other operations. When the wood, however, is very dirty, it is absolutely necessary to wash it all over with a sponge and hot water, before the thin white is applied; which precaution will prevent the chipping-up of the preparation. When burnished, the thin white should be particularly well dried: after which, the work is to receive four coats more of that composition which was made, as described, of the consistence of cream, warmed, but not made so hot as for thin whitening;

taking care that one coat is dry, before another is applied. And here it is necessary to observe, once for all, that, throughout this process, one coat must always be dry, before another is laid on, whatever may be the composition used. The sixth coat, which is also of *thick white*, must be laid on, by passing the brush in a smooth, even and flowing manner, over two feet in length of the work at a time, in order to gain a surface, and facilitate the smoothing, hereafter to be described. Before the whitening is dry, the flat parts should be rubbed down with a chisel, the hollows with a gouge, and the rounds with the finger or fingers, as may be most convenient: should the hollows be too large for a gouge, the finger will answer every purpose. When dry, any superfluous whitening, that may have fallen over the edges of the mouldings, &c. may be lightly pared off with a chisel or gouge, according as the parts are situated: then give it a seventh coat, similar to the preceding; and it will be ready for smoothing, which should be performed in the following manner:

Take some close-grained pumice-stone, and, with a sash-saw, (an old one will answer the purpose,) cut it into pieces, about three or four inches long, (if the work be very small, an inch, or an inch and a half will do;) fit them to the different mouldings, using a rasp to form the rounds, and a gouge for the hollows. The flats are to be made by rubbing the pieces of pumice-stone on a smooth flat stone, making their sides at right-angles to each other, that they may smooth two sides at once. During these operations, the pumice-stones must be frequently dipped in water. Lay the pieces thus prepared in a large earthen pan full of water, not less than two quarts; then take a hog's-hair brush and a sponge, both of convenient sizes: dip the brush in water, and wet about two feet in length of the work at a time, taking the mouldings alternately: then with the pumice-stone, already fitted, rub up and down, till a smooth surface is obtained: remove the water with the brush, and squeeze it into the pan: what water remains may be taken off with the sponge, which will complete the smoothing of that part. Proceed in the same manner with similar portions; for if too much be wetted at a time, the whitening becomes soft, and unfit to bear the pumice-stone. The frames must then be set aside to dry.

In carved work, the whitening and smoothing differ somewhat from the preceding. After the thin white is dry, the coats that follow must be rather weaker; or not so thick as for frames or mouldings: they are to be laid on, by carrying the brush over the work in an even and smooth, but not flowing manner. To smooth them, or produce the surfaces that are required, pieces of lime-wood, or fir, soaked in water, are used instead of pumice-stone; and are shaped round, flat, or angular, as may be found necessary, occasionally wrapping around them strips of coarse linen cloth. In smoothing, care must be taken not to rub off too much of the whitening, or the gilding will look poor; and it would prevent the burnishing of those parts which were thereby brought too near to the wood. The drying may be hastened in summer, by the sun; or, in winter, by placing the work before a fire; but not too near, or the whitening would chip

off. Mix a little strong size with four times as much water, in a half-pint earthen pan: the proportions should be so adapted, as to make it three parts full: for instance, the quantity of size may be equal in bulk, to two large walnuts, and half as much prepared yellow ochre must be added to it: mix the ingredients well together; and, with a brush, coat the work once over therewith: when dry, rub it slightly with glass-paper, half worn out, to improve the surface; and proceed to mix, and lay on the gold size as follows. In another half-pint earthen pan, half full of clear size, mix a quantity of burnished gold size, twice as big as a large walnut, with which coat the work twice over. When dry, burnish the parts intended to be matted, with an agate burnisher; and then give it another coat of the same gold size. The size must now be reduced, by adding to it about two tea-spoonfuls of water, and as much gold size as you can take upon the point of a knife: with this, coat those parts only that are intended to be burnished. And here it must be observed, that in laying gold size on carved work after it is yellowed, those parts should be missed that are too small to receive the gold, even from the smallest pencil; such as the small eyes of foliage, &c.; effect to which must afterwards be given, with high coloured *or moulu*. We may now proceed to lay on the gold with a cushion-knife and tip, as will be described in oil-gilding: but in burnish-gilding, camel's-hair pencils must be used for small parts, and swan-quill pencils for the larger ones, dipped in clear water, to wet the work as fast as the gold can be laid on. The hollows and flats must be gilt first, and be perfectly dry before the other parts can be proceeded with: when the work is all gilt, and dry, burnish the parts intended to be so treated. Should there be any faults, which can only arise from the parts not being carefully wetted, or from grease, those parts must be rubbed through to the whitening, by means of linen wrapped round the finger: when they are dry, they must be gold-sized, gilt, and burnished.

Then reduce a little clear size with hot water; so that, when cold, it will merely set: this, being the weakest size used in burnish-gilding, much care should be taken that it be not too strong, or it will show all the joints of the gold. Lay on a coat of this; and when completely dry, rub it over with cotton-wool. In double gilding, which is the best style, the matted parts should be again gilt, using water to wet as before; after which, coat them again with the weak size, use the cotton, and, if faults appear, treat them as will be directed in '*oil-gilding not to stand the weather*.' After the faults are all covered, give them another coat of the weak size, use the cotton, and then give a coat of clear size, to keep the gold firm: a coat of *or moulu* completes the process. Observe, swan-quill and camel's-hair pencils only are used, after the gold is laid on; and care must be taken, in sizing the matted parts, not to touch those that are burnished, which cannot be improved after the burnishing-stone.

If it be necessary to embellish the frames, or other work to be gilt, with composition ornaments, they may be had, in London, soft from the press; and can be put on, after the smoothing, with a little

hot thick whitening, or weak glue. What is squeezed out round their edges, in pressing them close, may be taken off with a brush and cold water: they must then have a coat of thin white, to remove any grease, and be finished like the rest of the work. The composition ornaments may also be put on oil-gold work, that is not to stand the weather, but does not then require the thin white: they must be finished in the manner of oil-gilding. Composition ornaments are easily moistened, when dry, by wrapping them in a wet linen cloth for twenty-four hours.

[TO BE CONTINUED.]

On the Preparation of Enamel Colours, and Fluxes; and the Vehicles for laying them on with. *By Mr.* ROBERT WYNN.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

PAINTING in enamel colours has always been considered interesting, and is one of the most costly productions of art, in every country where practised; but the real preparation of the colours has always been confined to the knowledge of a few persons, who have made a mystery of it; and whatever has been yet published on the subject, appears to be chiefly the compilation of writers unskilled in the profession. Many artists of superior talents, in different parts of this country, could practise the art, but for the difficulty of procuring a good set of colours: indeed it is extraordinary with what suspicious secrecy the art of making enamel colours has hitherto been conducted. I have been acquainted with several of the best manufacturers, whose colours were used by the most eminent painters, on the finest and most elaborate works of the time; but who have died without ever benefitting their country by publishing their acquirements, or leaving any documents behind them. It is not indeed impossible, that the present improved state of knowledge in the art, might be entirely lost, were not some experienced professional person to seek an opportunity of making it public. With these motives, I take the liberty to offer the accompanying treatise, which consists of the most valuable selections from the experience and labours of above twenty years.

Introductory Remarks.

The different qualities, or degrees of purity in the ingredients, as usually met with, will, while following the same prescriptions, nevertheless produce some slight variations in their effects: but the best enamel colours may always be obtained with certainty, by careful attention to the following directions.

When metals are dissolved, their solutions should always be per-

fectly saturated. In making the fluxes, they should be sufficiently melted in the crucibles, to flow liquid, and pour out easily.

The various qualities of the materials, or surfaces, on which painting in enamel is performed, require the colours to be adapted to the degrees of heat they will bear, or require, when burnt; and it is the general practice of the best painters in enamel, to use for the first painting and burning, colours considerably harder than those used in the second; the latter being fine soft enamels, in order to finish the work, and give it a beautiful polish. It cannot but be obvious to every person who uses enamel colours, that the hardening them, if necessary, will be effected by adding more of the colouring matters, or lessening the quantity of flux; and, if required to be more soft, or to shine more when burnt, to add a little more flux; and this is best done by a very soft flux, generally used for this purpose, such as No. 8: but when particular directions are necessary, they will be mentioned in the receipts for making the colours. It will be better to make a few ounces, at least, of each colour at a time; and they must all be ground as soon as made, in water, with a glass mullar, on a piece of plate glass; then be dried before the fire, scraped off in powder, and kept in bottles for use.

When used for painting with, they are ground in spirits of turpentine, and thickened with thick oil of turpentine; this quality, the fluid oil of turpentine acquires in three or four years.

PREPARATION OF THE MATERIALS.

Flint Powder.

Take pieces of flint, which have been burnt white at the chalk lime-burners; make them clean with hot water and a brush; then throw them, when heated red-hot, into cold water: after having thus treated them two or three times, pulverize them in a biscuit-ware mortar, with a pestle of the same material, (which will be easily effected,) and then grind them in water, on plate glass.

Where no opportunity occurs of procuring burnt flints from the lime-burners,* the common black flints, broken into pieces, made hot in boiling water, (to prevent their flying in the crucible) and treated in the same way, will produce a fine white powder.

Red Sulphate of Iron.

Sulphate of iron, otherwise called green vitriol, is to be pounded, and placed in an earthenware muffle, till the moisture is evaporated, and a gray powder left; which, put into a crucible placed in a charcoal fire, and stir with a piece of steel bar, till it is of a fine red colour; then, let it fall out of the crucible into a pan of cold water, placed under a chimney, in order to avoid the disagreeable fumes that arise; when settled at the bottom of the pan, wash it in several

* In England, lime is frequently made by burning chalk, and the black flint which the chalk contains, is calcined in the operation; with us the calcination must be specially performed. EDITOR.

hot waters, and then dry it for use. The more it is burnt, the darker is the red.

Brown Sulphate of Iron.

Take sulphate of iron, in lumps, and calcine it, in a red charcoal heat, till it becomes of a deep brown colour; let it cool in the crucible, and afterwards wash it repeatedly in hot water.

Black Oxide of Copper.

Take copper, and dissolve it in aqua-fortis, till the acid refuses to take up any more metal; then dilute the solution with water, and add to it some sub-carbonate of potash dissolved in water; a green precipitate will fall to the bottom of the vessel, which must be washed in several hot waters; when settled, pour off the superfluous water, and place the green deposit on a piece of blotting-paper, supported upon a piece of coarse open canvass, tied over the mouth of a large earthen pan; after the precipitate has been thus drained, it should be taken off the canvass, and made perfectly dry, by placing the paper on powdered chalk, laid in a drawer, and put before the fire. When dry, calcine it in a crucible, placed in a charcoal fire, and throw it, red-hot, into cold water; then rinse it in boiling water, and dry it at the bottom of a basin, before a fire: this is a beautiful black oxide of copper.

Green Oxide of Copper.

Take a saturated solution of copper in aqua-fortis, and precipitate it with sub-carbonate of potash; then wash it several times in boiling water, filter, and dry it.

White Oxide of Tin.

Into a small wooden box, with a sliding cover, chalked all over inside, pour melted tin from a ladle, close and shake the box, till the tin becomes finely granulated; then wash and dry it, and put it into a clean Florence oil-flask, and pour over it strong nitrous acid, which rapidly converts it into a white powder. When a sufficient quantity of this is obtained, it should be well washed in several boiling waters, be poured out into a basin, and dried before the fire;—it is then a very white oxide of tin.

Black Oxide of Cobalt.

Take good metallic cobalt,* and dissolve it to saturation in nitric acid diluted with a little water, contained in a flask, placed in a sand-bath; then pour the solution into a large basin, and having added a quantity of water to it, pour into it a solution of sub-carbonate of soda, as long as any precipitate falls down: when settled, pour off the water, wash the powder in several hot waters, filter it, and dry

* In the choice of cobalt, that which, when dissolved in nitric acid, gives the purest and deepest red solution, generally makes the finest colours.

it. When dry, mix it in a biscuit-ware mortar, with a pestle of the same, with three times its weight of dry nitre; put the mixture into a warm crucible, and drop into it an ignited piece of charcoal: some slight explosions will then take place; and when these have ceased, make the calx red-hot: this, after being washed and dried, is the best oxide of cobalt for enamel; and is capable of forming various colours, single and compound.

Fluxes.

In forming these, take great care to mix all the ingredients accurately, in a biscuit-ware mortar, with a pestle of the same material, and to powder them as finely as possible. Let the crucibles be made warm, before the fluxes are put into them, (by placing them on the fire, with the open end downwards,) which will prevent their breaking in the fire.

The best furnace for making fluxes, or for any other purpose that requires great or continued heat, is a common German stove, about 18 or 20 inches diameter, lined all round, from the grate to the top, (except the aperture at the door in front, for the occasional introduction of a muffle,) with one row of fire bricks, set with loam; the iron-pipe of the chimney projects from the back part, near the top. The top or cover of the furnace must be loose, like a lid, and be removable by handles; in the centre of it a circular hole must be made, which must also be fitted with a cover, and through which hole, the cover of the crucible may be lifted off, and its contents stirred up with a bar of steel. A small piece of fire-brick must be placed on the grate, for the crucibles to stand on; and the fuel should be either charcoal and coke mixed, or charcoal alone.

Flux, No. 1.	Red lead, ...	8 parts, by weight.
	Calcined borax,* . . .	1½ parts,
	Flint powder, ...	2 parts,
	Flint glass, ...	6 parts.
Flux, No. 2.	Flint glass, ...	10 parts,
	White arsenic, . . .	1 part,
	Nitre, ...	1 part.
Flux, No. 3.	Red lead, ...	1 part,
	Flint glass, ...	3 parts.
Flux, No. 4.	Red lead, ...	9½ parts,
	Borax, not calcined, . .	5½ parts,
	Flint glass, ...	8 parts.
Flux, No. 5.	Flint glass, ...	6 parts,
	Flux, No. 2, ...	4 parts,
	Red lead, ...	8 parts.

* Borax, calcined to a dry white powder in a crucible, only a third part of which should be filled at once, on account of the borax swelling up so much, as it gets hot.

Flux, No. 6.	Flux, No. 2, ...	10 parts,
	Red lead, ...	4 parts,
	Flint powder, ...	1¼ parts.
Flux, No. 7.	Flux, No. 4, ...	6 parts,
	Colcothar, ...	1 part.
Flux, No. 8.	Red lead, ...	6 parts,
	Borax, not calcined, . .	4 parts,
	Flint powder, ...	2 parts.

After the fluxes have been melted, they should either be poured upon a flag stone, wetted with a sponge, or into a large pan of clean water; they should then be dried and finely powdered in a biscuit-ware mortar, for use.

[TO BE CONTINUED.]

A description of the mode of extracting the Fecula from the Potato.

Communicated from G. G. Barrell, Esq. Consul of the United States at Malaga, to H. A. S. Dearborn, Esq. Boston.

[CONCLUDED FROM PAGE 55.]

With a Copperplate.

Malaga, June 1st, 1827.

Dear Sir—I wrote you a few lines some days since, and am now glad to send you the drawings of the machine for making starch, which I presume will be found perfectly clear, to any person acquainted with mechanics. It has given me some considerable trouble to procure the drawings, in the different sections in which I send them; but they are perfect, and any person whose mind has been dedicated to machinery, will, at once, understand them.

I am more and more convinced, that this article may become of most beneficial importance in the United States, where potatoes had their origin, and where industry and genius, unshackled by arbitrary power, and free from unjust and ruinous taxation, may range unrestrained through every field of science. I hope some of your friends will make the experiment without delay, as it cannot cost much, and from actual experience, I know it will succeed, and in the United States may be carried to any extent.

I have eaten the flour in a variety of shapes, for it is capable of making the finest pastry, excellent puddings, cakes of every description, gruel, broth, &c. &c. and the innocence of it, with its lightness upon the stomach, will unquestionably recommend it to our intelligent medical gentlemen, as a desirable food for weak and debilitated people.

I am unable to give you any further explanations, than what my former letter contained, respecting the machine. It is extremely

simple, although on paper it appears complex; but with the aid of the letter I sent you, any person can understand it.

I feel extremely obliged to you, for the handsome manner in which you have been pleased to speak of me. It will always afford me great delight to be found serviceable, in any degree, in promoting agricultural pursuits, or any thing else which may call industry into action, for from them spring a nation's happiness: it always has been so, it is so, and so it must ever remain; and every nation on earth, which has neglected to protect them, has decayed and been ruined; but I hope in the boundless extent of our happy country, thousands of centuries may pass away, before our rulers will forget to cherish the moral and industrious pursuits of that best part of mankind—I mean the tillers of the soil.

I am, with great regard, &c.

GEO. G. BARRELL.

H. A. S. DEARBORN, Esq.

The foregoing communication was accompanied by drawings in detail, which are now in the hands of the Editor; as the oval tub, the stand, a fly wheel, and every other part is separately represented with a minuteness not necessary to our workmen, some of them have been omitted, but enough has been engraved for all useful purposes.

Description of the plate of the Machinery for extracting the Fecula from Potatoes.

Fig. 1st. Side view elevation of the grating machine.
A, section of the hopper.
B B, cog wheels connecting the two cylinders.
C, tub containing water, in which the cylinders revolve.
D, frame to support the cylinders.
E, wheel and crank for giving motion to the cylinders.
Fig. 2. Bird's-eye view of the cylinders, frame and tub.
Fig. 3. Section of the hopper and cylinders, with the pieces to guide the potatoes.
Fig. 4. Section of the cask for washing the potatoes, which is furnished with a door on one side, in a manner similar to the common barrel churn.

On recovering Gold or Silver from old Gilt or Silvered Wood, &c.

UNTIL very lately, the small quantities of gold, or silver, that could be procured from the surfaces of wood, &c. which had been gilt, or silvered, was not thought worth the trouble of taking off; and this wood was burnt the same as any other fire-wood, without even searching in the ashes for the gold, or silver, they contained. Persons, who were aware of its value, bought this sort of wood at a very cheap rate, and burnt it by itself, on their hearths; and afterwards, with

great trouble, collected from among the ashes, all the gold, &c. they contained, by the process of amalgamation. This was difficult and troublesome, on account of the vast quantity of ashes produced by the wood; and in consequence of the thick coating of carbonate of lime, with which it had been covered, this process was by no means economical.

The following simple means may be employed with profit.—First, steep the wood in boiling water, and for this purpose, a trough must be made, capable of receiving the longest pieces, and sufficiently wide to contain a number of them; then pour on the wood a quantity of boiling water sufficient to cover it, and cover the trough with a lid, which closes it as perfectly as possible, in order to retain the steam of the boiling water, as well as to keep it hot for a long time. The operation is, however, performed better, and in less time, by means of the steam of boiling water, which may be introduced into the close vessel containing the gilded wood; and to which a safety-valve is applied; or, perhaps still better, by putting it into a boiler of the form of the trough we have described, and setting it upon the fire. The boiling water, or steam, dissolves the glue, or size, which secured the leaf-gold; which on being detached falls into the water. In order to accelerate the separation of the leaves of gold, they take out the pieces or gilt wood, after they have been steeping for some time in the boiling water; they then put them into another vessel, containing a little hot water, and, with a brush wetted in this water, they brush over the gold, which easily separates and remains in the water; into which they are also careful frequently to dip the brush. The coat of size and whiting remains almost entire on the wood; and a part of the gold size only is removed with the gold, and is found mixed with it in the water.

They allow the water to remain at rest; and when the whole is precipitated, they decant the water, and evaporate the deposit to dryness. They then remove the matter found at the bottom of the vessel, powder it in a mortar, and expose it to the action of fire under a muffle, in order to burn all the glue and the greasy or oily substances which formed a part of the coating. The gold is then separated from it by amalgamation.

This process is also applicable to old gilt plaster; and whether it be taken off the wall, or remain upon it. In the latter case, the gilded part must be washed with hot water and a sponge, and be thoroughly cleaned off with a hard brush, frequently dipped in the hot water. But we must by no means neglect to collect together the mortar, &c. which falls off from the walls so treated; as it generally contains a great quantity of gold, which it is important to unite in the *washings*. By this means, we have known to be recovered more than 800 franks' worth of gold, from an old chapel which was repaired.

The same process, which is made use of to recover the gold from gilded wood or plaster, is also equally applicable to the removing of any silvering which had been laid on with silver leaves. This, although less lucrative than that of recovering gold, must nevertheless

Fig.1.

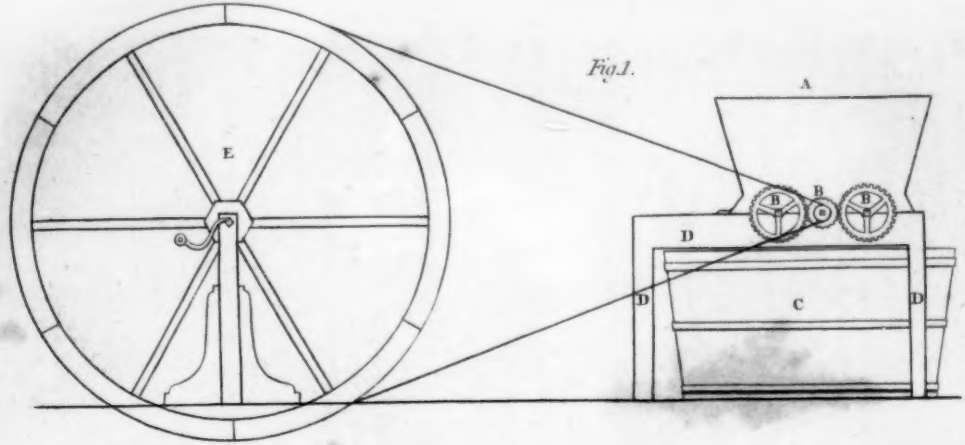


Fig.4.

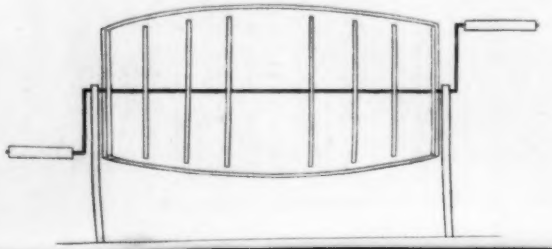


Fig.3.

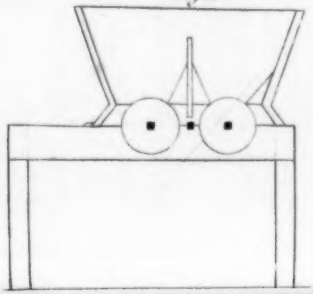
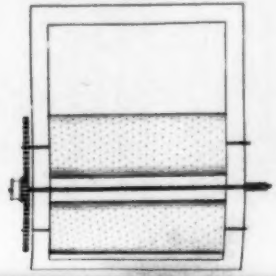


Fig.2.



not be neglected, as it produces very good results, when it is performed with dexterity and economy.

The gold and silver, also, from gold and silver lace, spun upon silk, when it is become old, may be burnt for the purpose of collecting the gold and silver. For this purpose it is made up into packets, like balls, wrapped round with iron wire, and made red-hot in a furnace; by this means the silk is reduced to ashes. When the packet is cold, they beat it in a mortar or kind of tray: the ashes all become powder, which they place upon a pasteboard, and fan or blow it gently, when the metallic parts, being the heaviest, remain, and the ashes are carried away by the wind. We must not, however, conceal the fact, that by this means, a little gold or silver will be lost; unless the ashes blown off be washed over afterwards.

There is, however, an easy means of preserving the whole of the valuable parts, if the operation is carefully performed. The lace or stuff must be cut into very small pieces, and be boiled for some time in soap-boilers' caustic lees (pot-ash, or caustic soda): these substances dissolve the silk; and the gold or silver remain pure in the liquor. The alkali must be washed off, and the deposit be afterwards *parted*, in order to separate the gold and silver.

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[*Dictionnaire Technologique.*

On the Preparation and Properties of a Colourless Refined Ox-Gall, for rendering Drawings in Water-Colours more bright and permanent. *By* P. W. Tomkins, *Esq.*

[From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.]

The refined ox-gall possesses all the valuable properties of ox-gall, as applicable to painting in water-colours: with the superior advantages of being deprived of all tendency to putridity, and of all colouring matters.

It combines with, and fixes all water-colours, as they are usually prepared; either by being mixed with them, or washed over them after they are laid upon the paper, &c. It renders blue, purple, red, green, and all other delicate colours, more bright and durable; and, if a small portion of it be added to any of the colours, it causes them to wash more freely and evenly, over the surface of the paper, ivory, &c.

Combined with gum-arabic, it gives depth of tint, without any unpleasant glossiness upon the surface of the drawing, prevents the gum from cracking, and the colours are so completely fixed in the paper itself, that subsequent tints can be washed over them, without any risk of their becoming foul, or forming improper combinations with the under colours.

Combined with fine lamp-black and gum-water, it forms a complete substitute for Indian ink.

If it be floated over the surface of drawings made with chalks, or black-lead pencil, it fixes them firmly; and they may then be washed over with any water-colours, previously mixed with a small portion of it; without, in the least degree, disturbing the chalks or black-lead.

For miniature-painting, being washed over the surface of the ivory, it completly removes its greasiness; and, being mixed with the colours, it causes them to float freely thereon; and tints may be laid over tints, the colours being struck into the ivory.

For transparencies, oiled paper being first washed over with the refined ox-gall, and permitted to dry, water colours, mixed with some of it, will lie freely and perfectly smooth upon it; and be so fixed, as not to wash up by the repetition of different glazings of colours over each other, thus producing depth of colour.

In short, the valuable properties this refined ox-gall possesses, make it equally applicable to historical, landscape, botanical, and natural history painting, as well as to colouring prints in general; and, by its readily combining with all the vehicles used in the preparation of water-colours, and having no colour itself; it enables the artist to paint with ease, on surfaces otherwise unfavourable; at the same time rendering the colours more bright and durable.

Many other valuable properties will, no doubt, on trial, be found in this preparation; and the result cannot fail to facilitate and improve the art of painting in water-colours: and, as the discovery of it is entirely new, it will, in all probability, be found applicable to many other useful purposes.

Process for depriving Ox-Gall of its Tendency to Putridity; and of its Colouring Matter, so detrimental to all Delicate Colours.

To a pint of fresh ox-gall. boiled and skimmed, put one ounce of alum finely powdered; continue it on the fire until combined; when cold, put it into a bottle, and cork it moderately close.

To another pint of fresh ox-gall, also boiled and skimmed, put one ounce of common salt, and continue it on the fire until combined; when cold, put it also into another bottle, and cork it moderately close.

Gall, thus prepared, will keep perfectly free from putridity, or any offensive smell, for years.

When the above preparations have stood in a room, of a moderate temperature, for about three months, they will deposit a thick sediment, crusts will form on their surfaces, they will become clear, and be fit for use in ordinary purposes; but, as they contain a large proportion of yellow colouring matter, tinging blue of a greenish hue, reds brown, and sullying purples; they are unfit for general use, in painting in water-colours.

Further Process.—The before-mentioned preparations, after stand-

ing until they are become perfectly clear, are to be decanted, and combined in equal proportions; a thick coagulum is instantly formed, of the yellow colouring matter, which precipitates; leaving a clear liquid, namely, the colourless ox-gall.

N. B. After the combination of the two first preparations, the process may be assisted, by filtering the liquid through paper. Age renders this preparation more brilliantly clear; and from it, it seems to obtain an agreeable scent: nor has it been observed to contract at any time an unpleasant smell, or to lose its useful properties.

ENGLISH PATENTS.

To Joseph Luckock, *Gentleman, for an Improvement in the Manufacturing of Iron.*

This improvement consists in the application of muriate of soda, (common salt) in that part of the process of making iron, which is denominated *puddling*. The patentee states, that he "applies salt to the puddling of iron in the puddling furnace, only when pig iron, or iron of any other form, quality, or denomination is puddled therein, in the state in which it comes from the smelting furnace, commonly called in the trade the 'blast furnace,' and which when erected upon a smaller scale, is commonly called 'a cupold,' or a 'cupold furnace;' and whether such blast, or cupold furnaces, are used to melt, refine, or run out, a proportion of pig-iron, or other iron previously smelted, or made in such kind of furnaces, at the time that they are used to smelt iron-stone, or other iron ore, as is sometimes the case."

It is asserted, that by the application of the salt, malleable iron can be manufactured at less cost, than by any other known method. The salt is applied at the time the iron is fusing, or breaking down; the proportion used, is seven pounds weight of salt, to three and a half hundred weight of iron; it is applied pulverized, or in small pieces; this proportion has to be varied, according to the nature of the iron to be refined. A preference is given to those puddling furnaces which have iron, instead of clay, bottoms.

To William Jefferies, *Brass Founder, for improvements in calcining, or roasting, and smelting or extracting, metals and semi-metals, from various kinds of ores, and matter containing metals and semi-metals.*

The ore, or other matter, containing metals or semi-metals, is in the first place to be broken or crushed by stampers or rollers, until it becomes so fine as to pass a wire sieve, of eight or ten holes in the inch. After which, instead of introducing such pulverized ore or metal into a roasting oven or furnace, with a separate fire, I mix and incorporate the same with a sufficient quantity of small coal, or large

coal which has been broken down, and I then introduce the mixture thus formed, into an ordinary coke oven, which has been previously heated in the ordinary way; and I cause the mixture to be coaked in the same manner as if coal alone was used; that is to say, by leaving the door, or mouth, of the coke oven open, until all the flame has worked off, and then closing it, and destroying all draught of air to prevent the further consumption of the fuel. The charge is then to be drawn in the same way as if it were common coke, and, after cooling, it is to be broken down into masses, of a proper size, for the smelting furnace, to which it is next to be carried, for the purpose of smelting out the metal, or semi-metal, from the coke with which it was before combined, and which becomes a part or the whole of the fuel to be consumed whenever coke is used in the smelting furnace, which may be of the ordinary construction for smelting or reducing the particular kind of ore under treatment. In selecting the coals for the above process, those which contain the least quantity of sulphur are to be preferred; but as the quality of coals, as well as of ores, or matters containing metals or semi-metals, varies in every district, and even in the same mine, it is utterly impossible to specify the quantity or proportion of coals and ore, or other metalliferous matter to be used; but this will be readily ascertained by any competent workman, who has been accustomed to roasting by the former, or usual processes, and cannot be described in words, because the completion of the roasting operation can only be determined upon by the appearance of the ore, and of the flame and fumes which arise from it in the furnace. The only rule which I can therefore give, is that there ought rather to be a superabundance than a deficiency of coal mixed with the ore, because by such superabundance, the full completion of the calcining or roasting process will be insured, and as nearly the whole of the coal will be converted into coke, to be afterwards used in the smelting furnace, but little of the fuel will be wasted or improvidently expended. Nevertheless, the coke oven must not be closed, even though the coals may be consuming, until it has been ascertained that the roasting has been fully accomplished, by inspection of the fumes and flames; and if, on the contrary, a sufficient quantity of coal has not been incorporated, as aforesaid, with the ore or other matter, an additional quantity of coke must afterwards be added during the operation of smelting. In the old, or accustomed, method of roasting ores, a separate furnace, or oven, and fire are always employed, and the pulverized ore requires to be constantly stirred on the hearth, to expose every part of it to the action of the fire, and prevent the top surface from running or vitrifying, and thereby protecting what is underneath it from the flame. Coke is also separately prepared for the smelting furnace, without any useful application of the heat produced in making it. But by my improvements, as above described, both these operations are combined in one, thereby producing a great saving in fuel and labour, as well as a more perfect and complete operation, because by the mixture of the pulverized ore with the small coal in the first instance, every part of that ore becomes ex-

posed to the full action of the fire, without any chance of its running together, and without its requiring to be stirred or attended to in the oven, except only to watch for the completion of the process of roasting, as ascertained by the discontinuance of the flame, and appearance of the fumes when the coke oven is to be closed, as usual. By means of my said improvements, the usual roasting fire is completely saved, and the heat of the coke-making, employed in its stead, thus combining several operations into one, with a more beneficial result.—Enrolled, February 20, 1827.

[*Repertory of Patent Inventions.*

To William Hobson, *Gent., for an improved method of paving streets, lanes, roads, and carriage ways in general.*

Instead of picking up the ground loose (as is the practice in the present mode of paving,) ram the ground on which the paving is to be placed, well down, until it is as solid as possible, to a form corresponding with the form the surface of the paving is to take when finished. The stones should be sorted, so as to be nearly of an equal depth; mix up gravel or small fragments of stones with lime and water, into a composition or kind of coarse mortar, and lay a bed (of sufficient thickness, to allow for the irregularity of form in the bottom of the stones) of this composition, on the ground which has been previously rammed, and in this composition place the paving stones, and grout them full with finely sifted gravel or coarse sand, mixed up into a liquid state with lime and water, in the same proportions as the composition the stones are laid in. All the paving done in one day must on the same day be well rammed to an even surface, and when so done must be again grouted full, with fine gravel or coarse sand, mixed up with lime and water, as before. This must be done with each portion of paving, on the day on which the paving is executed, and this method of ramming and grouting must be followed up on each day as the paving proceeds, and when so done, it would (if practicable) be desirable that the part paved should be left without carriages being permitted to go over it for three or four days, in order to let the composition of lime and gravel, or stone, set and harden, and it will then become firm and solid, and, if the lime is of a proper quality, impervious to water. This method, if applied to paving done with pebbles or unsquared stone, will be found advantageous in a proportionate degree to paving done with squared stones. I recommend that the lime to be used in this method of paving should be stone, or gray chalk lime, as lime of that description will set and harden in water, and if of a good quality, the proportions of one measure of lime to four or five measures of gravel or small fragments of stones will be sufficient.—Enrolled, January 15, 1827. [*Ib.*

Description of the method of preparing Oil Colour Cakes, invented by Mr. George Blackman.

Take of the clearest gum mastich, reduced to fine powder, four ounces; of spirits of turpentine, one pint; mix them together in a bottle, stirring them frequently till the mastich is dissolved: if it is wanted in haste, some heat may be applied, but the solution is best when made cold. Let the colours to be made use of be the best that can be procured, taking care that, by washing, &c. they are brought to the greatest degree of fineness possible. When the colours are dry, grind them on a hard close stone, (porphyry is the best,) in spirits of turpentine, adding a small quantity of the mastich varnish. Let the colours so ground become again dry; then prepare the composition for forming them into cakes, in the following manner. Procure some of the purest and whitest spermaceti you can obtain; melt it over a gentle fire, in a clean earthen vessel; when fluid, add to it one-third of its weight of pure poppy-oil, and stir the whole well together; these things being in readiness, place the stone on which your colours were ground, on a frame or support, and, by means of a charcoal fire under it, make the stone warm; next grind your colour fine with a mullar; then, adding a sufficient quantity of the mixture of poppy-oil and spermaceti, work the whole together, with a mullar, to a proper consistence; take then a piece, of a fit size for the cake you intend to make, roll it into a ball, put it into a mould, press it, and it will be complete.

When these cakes are to be used, they must be rubbed down in poppy or other oil, or in a mixture of spirits of turpentine and oil, as may best suit the convenience or intention of the artist.

N. B. It may be proper to observe, that Mr. Blackman's colours in bladders, are prepared with a mixture of spermaceti, and differ from his cakes only in having a larger proportion of oil.

Method of making Tablets similar to the German asses-skin, from which writings, or drawings made with a pen and ink, or a pencil, may readily be rubbed off, when desired.

Take either vellum, parchment, very fine cloth, or paper, and stretch it in a frame as tight as possible. Then take twelve pounds of white-lead, and pound it very fine; add thereto one-third part of the best plaster of Paris, and one-fourth part of the best stone-lime; pound them well, mix them well together, and grind them very fine with water. Then take a new glazed vessel, and dissolve six or seven pounds of the best double size, over a fire, and mix the above ingredients in this, till it is of such a consistence as to lay on with a brush. Then lay three or four layers on the skin or cloth, as smooth as possible; observing that the skin is dry each time, before a second layer is put on. Then take the best nut or

linseed-oil, and to every pound of this oil add four ounces of the best white varnish, and mix them well together. Then put on three or four layers of this oil, thus prepared, each time exposing it to the air till it is thoroughly dry: this is for the white sort. For a brown or yellow, add to every pound of the above, three or four ounces of the best stone ochre, or orpiment, or Dutch pink, and three or four ounces of litharge. These must be well ground with very old linseed-oil, and laid on, as smooth as possible, ten or twelve times; exposing it each time to the air, to be thoroughly dry, before a second layer is put on: observe you do not put it where any dust or dirt can fall upon it. It may be, by the same process, altered to any colour: as for instance; to a red, by tincturing it with vermilion, or the like; to a blue, by Prussian blue; and for a black, by pounding slate, grinding it very fine, and mixing with it as much ivory black as will turn it to a fine black colour. When it is thoroughly dry, you may write on it with a slate-pencil, or black or red lead.

On New and Improved Lutes and Cements. By Mr. James Deville.

Those manufacturers who are concerned in the use of plaster of Paris, have long been acquainted with cements of the nature of that published, as *Varley's Cement;* (Vol. I. p. 115,) the chief difference being, that *plaster of Paris*, mixed with rosin and a little bees'-wax, is employed instead of whiting, or chalk; and it is preferred, on account of its being freer from moisture than either of the other substances.

I have found the following lute or cement of great use in many cases, but particularly for closing the joints of the apparatus, during the very extensive course of experiments which I have made on the production of *oil-gas*. It is prepared as follows:

Take equal parts, by bulk, of white lead ground in linseed-oil, (as sold in the colour shops) and plaster of Paris, and well knead them together just before using the cement; and, when every thing is ready for joining, add a little water to it, more or less, as the cement is required to be thicker or thinner, and apply it immediately. In a few minutes it will *set;* and it is astonishing how very hard it becomes in the course of a few days.

This lute or cement is entirely of my own inventing, and the result of necessity, in not finding any of those usually employed to answer my purpose, and I hope that it may prove as useful to others, as I have found it to be in my own pursuits.

On an Indelible Ink, and on Bistre. By John Mac Culloch, M. D.

The perishable nature of our common ink is, as you well know, a frequent source of serious inconveniencies, particularly in the case of records, which it is important to preserve, if possible, for ever.

The cause is too well known to chemists to require mention; and they also know the processes that have been recommended for the restoration of manuscripts which time has rendered illegible or obscure. In a minor way, we are often teased with the obliteration of our labels or memorandums of experiments in our laboratories, where acid vapours are often let loose so as to affect the atmosphere of these places. Mere damp, I need scarcely say, has the same effect of rendering writing, made in common ink, brown and indistinct; and the same effect sometimes arises from using a bad kind of this most indispensable substance.

Numerous projects for an indelible ink, have been brought forward at different times; but none of these are effectual, except where they contain powders that are exempt from the operation of the destroying causes. The ancients used charcoal in some form, as we have attempted to use lamp-black, whether in that of Chinese ink, or in some other shape. This is indelible, as is the ink of the cuttle fish, formerly used by the ancients, and still employed as a paint by modern artists, under the name of sepia.

But there are two objections to these powders, of whatever kind, which has, hitherto, prevented them from coming into general use. It is necessary that they should be mixed with glue or gum, without which they will not adhere to the paper. These substances, as well as the powders themselves, prevent inks of this nature from flowing freely through the pen, particularly in warm rooms, or hot weather; and hence the process of writing becomes tedious and irritating. They have another fault, of no small weight, namely, that in damp situations, they become mouldy, and are at length destroyed, so as to permit the powders to get loose, and the writing to be obscured or obliterated.

The substance which I have sent you is free from all these faults at least; although it still labours under some defects, which may perhaps prevent it from being generally introduced as an ink. Yet, as it is absolutely indelible, by acids as well as by time, it is worthy of attention, particularly in the cases above alluded to, where a little imperfection will be compensated by the advantages it holds out.

It is prepared from the substance called Bistre, the nature of which I formerly investigated in a paper published in the Transactions of the Geological Society.

This substance is a compound of carbon, or charcoal, and hydrogen, principally; very analogous to the bitumens, but differing from them in some particulars, which I need not here detail. It is most conveniently procured from the destructive distillation of wood, and can now be obtained, in any quantities, from the distillers of charcoal for the gunpowder manufactories, and from the manufacturers of new vinegar.

When thus obtained, it is a liquid resembling common tar in consistence; and it is this substance which forms the beautiful brown varnish, that covers the inside of a Highland cottage; being deposited from the smoke of the peat. On being subjected to evaporation or distillation, it gives out an essential oil, either colourless or brown,

according as the process is managed, analogous to naptha and to petroleum, together with acetic acid. Being thus treated, it becomes first tenacious, like soft pitch, then hard or brittle like asphaltum, with a bright, clean, conchoidal fracture. The longer the heat is continued, the more brittle it becomes, till at length it falls to powder.

The chemical change which here takes place, is that of gradually diminishing the hydrogen in the compound; and, if the process be pushed to an extremity, charcoal alone at length remains. At the same time, the colour, which was at first a yellow brown, becomes gradually darker till it settles into one that is nearly black.

In a hard state, this is the bistre of artists, although that substance is ignorantly obtained from the soot of wood, particularly beech, if possible; being generally furnished to the colourmen by the chimney-sweepers, who collect it from those places where wood is burnt. For this reason, it is a very uncertain colour as to its tone; while artists also know well that it is often glutinous and disagreeable in use; adhering and returning to the pencil, so as to render it difficult to put on clear and repeated washes.

This fault consists in the evaporation not having been carried far enough; and, from the foregoing sketch of its nature, it will also be seen that the yellowish varieties will be the most disagreeable in working. The obvious remedy for these evils, is to evaporate the oil and the acid; and that evaporation may be regulated to the greatest nicety, by adopting the liquid tar of the charcoal and vinegar distilleries. Thus it may be procured of the colour of sepia; which indeed it may be made to rival in use, as it is the same substance, considered as a chemical compound.

There is one other objection to the use of bistre, in water-colour painting, and that is its powdery nature; as it is, like other colours, merely suspended in gum. This evil is remedied by the same process which converts it into an ink.

It is soluble in the pure alkalies, both potash and soda; with which it forms a compound analogous to soap, and which is in fact, the same, very nearly, as that which common rosin forms with these, in that mixture of this substance with tallow, which produces what is called brown soap.

But it must be remarked, that the combination with potash remains liquid, if not too far evaporated, while that with soda gelatinizes, even when much water is present. The process itself is extremely simple, as it consists merely in boiling the bistre in the alkaline solutions, taking care that they are fully saturated. The degree of dilution may be regulated at any time, according to the uses for which the colour is intended.

It is not easy to give precise directions for the state in which the bistre ought to be used, for want of a scale of reference. But it cannot well be too brittle and too dark in the colour, provided it has not been so far evaporated as to destroy its solubility. To bring it to the condition of asphaltum, is, perhaps, a good general rule.

In a fluid state, this is the indelible ink in question. There is no

powder here, as the bistre is in a state of solution, and it requires neither gum nor any other addition. It remains unchanged in a bottle, never depositing its colour, like common ink. It flows freely through the pen, and can be used to write as rapidly as ordinary ink. It is so incapable of change, as to resist even oxymuriatic gas: nor is it affected by any exposure to damp. I may add, that I have kept a manuscript for ten years, and more, exposed to the vapours of a large laboratory, where acid was always present, and where the paper was constantly damp, but without the slightest alteration.

Its defects are the following: It acts on the quill so as to blunt it rapidly, and to prevent the pens from giving fine hair strokes; no great evil compared to its advantages; and one which is obviated by the use of a metallic or a reed pen. It is more easily washed out by water than common ink; although it is difficult to discharge it entirely in this way, as it penetrates into the substance of the paper. This is a defect, however, to which all the powder inks are completely exposed, nor is it a trial to which manuscripts are likely to be subjected. Lastly, the colour is brown and not black. If that is a defect to the eye, it is one that arises merely from habit. It is, notwithstanding that, more visible than ordinary ink; as artists well know that brown is a more powerful colour than black, and forms a much more *forward* colour, or offers a stronger contrast with white.

Such are its advantages and disadvantages; and I still think that the balance is so much in its favour, that it ought to be adopted for all public and legal documents, which it is so essential to preserve from obliteration.

This solution is also better adapted to water-colour painting, than common ground bistre. It makes a clear wash, which is not disturbed by fresh application, and which does not deposit powder, that vice of Chinese ink, which almost renders it useless in drawing. It has also the advantage of giving a degree of *forwardness*, or intensity, in the foreground, which cannot be obtained by common bistre; and, for this purpose, the solution in soda, may conveniently be used, on account of the facility with which the paper may be loaded with it.

In terminating these remarks, I may add, that, in the use of common ink, it is an error to write with that which is blackest, although most agreeable to the eye at first. When rendered thus black, which it is by keeping, a portion of the tanno-gallate of iron has been deposited in the bottle, in consequence of the process of oxydation; so that the fluid, though darker, contains less of this salt than the pale ink which is fresh made. The more that can be applied to the paper, the longer it is likely to last; and thus, when the faint-coloured new ink is used, the greatest possible quantity is attached to it; while, in a few days, it becomes as black as if it had been used in that state from previous standing. [*Brewster's Journal.*

On the Preparation of Bistre.

This colour, used by painters in the manner of Indian ink, is prepared from wood-soot, in the following manner:—Make choice of those pieces of soot which are the hardest, and adhere most to the chimney; pulverize them, and pass the powder through a fine sieve. Throw this powder into pure water, stir it from time to time with a glass spatula, leave it at rest; and, finally, pour off the water. This water dissolves all the foreign salts. We may hasten their solution by placing the glazed earthen-vessel containing the mixture, over a fire. When other water, on being added, will no longer dissolve any salt, and it remains of the same degree of specific gravity as before it was employed, we put the sediment into a tall narrow vessel, which is to be filled with water, and agitate it with the spatula; it is then left at rest for a few minutes, in order that the coarser parts may settle. The liquid is then to be poured into another similar vessel, and the coarser parts remaining at the bottom of the former one, may be thrown away as useless.

This operation may be repeated two or three times; and the oftener, the finer will be the bistre. It must be finally left at rest for some time, and the clear water poured off from the sediment, which is to be incorporated with gum-water, and it is fit for use.

[*Dict. Tech.*

Some account of the various projects for propelling carriages by means of Steam. (From the Register of Arts;) with preliminary remarks by the Editor.

To propel carriages without the aid of animal power, has long been a favourite project, more particularly since the improvements which have been made in the steam engine, especially in the use of highly elastic steam, by which the power of the old engine has been retained, whilst a large portion of its weight has been dismissed. We have taken from the Register of Arts, a short catalogue of propositions, or trials, which have been made upon this subject; and could add largely to the list, but think it altogether unnecessary, as but few of these schemes would form an item in the history of improvements. The editor of the Register, we think, has done more than justice to the projects of our late friend, Oliver Evans, where he says, that "the public trials made in Philadelphia, of his steam-wagons, afforded demonstrative proofs to scientific men, of their economy, and of the practicability of their construction." We are not, however, disposed to complain on account of receiving too much praise, but would avoid the appearance of claiming more of it than is due to us. The fact is, that the economy and practicability of the project remain yet to be proved, both here, and in England.

We very much doubt the possibility of employing steam to propel

stages, and loaded wagons, on common roads, under which denomination we include our best turnpikes. The invention by Loch and Stevenson, of supporting the boiler, and engine, on springs, consisting of pistons and cylinders operated upon by the elastic force of the steam, has been found of high importance, even on the best rail roads; as that perpetual vibration to which all parts of the engine are subjected, when fixed upon a carriage, and unsupported by springs, soon disarranges them, even upon iron ways. The observation of Mr. Hazard upon these spring pistons, in his paper, vol. 3, p. 275, we have always thought incorrect; he says, "upon close inspection, while the engine was travelling, I am convinced that they did not move." We should not expect their motion upon a rail-road, to be such, as to be *visible* to a looker on, but we apprehend that the difference between a loco-motive engine, with and without them, would be plainly *felt*, by a person riding upon them; his further objection to their utility, that, "if the boilers, with the cylinders attached to them, were raised by the small pistons from the axletrees, the connecting rods would thereby be rendered too short, to pass the dead centres," is, we apprehend, obviated, by giving an additional length to the cylinders of the engine, to allow for the rise of the boiler and engine.

That carriages can be made to run upon hard level roads, has been demonstrated, and indeed has never been doubted; but the unavoidable obstructions which must exist on the best roads, and even on the smoothest common pavements, would certainly, and rapidly, injure the machinery, whilst those elevations and depressions which must be encountered and overcome, if any good purpose is accomplished, would present difficulties which could not be obviated. An ascent which would be more than a balance for the friction of the wheels against the ground, would not be a very steep one; hence arises a difficulty not to be removed by decreasing the speed, and increasing the power; as this would make no practical difference in the friction; a rut, a gulley, a stone, or a soft place in the road, will produce all the effects of a steep ascent, with the additional one of a dangerous concussion. We have thought long, and seriously, upon this subject, and always with the result of confirming the opinion which we have expressed; and scarcely hope, that steam transportation, by land, can be extended beyond the progressive formation of rail-roads. Should occasion offer, we may hereafter urge our objections at greater length, than we at present think necessary.

Mr. Morey, whose vapour engine we formerly noticed, is now engaged in essaying its efficiency in propelling a carriage. Should it prove to be a good engine, it will be unique in point of lightness, in the room which it occupies, and in the trivial portion of material which will undergo combustion in giving motion to it. From an essay made three or four months ago, in propelling a boat on the Hudson, Mr. Morey entertains no doubt of its possessing sufficient power, either for steam boats, or loco-motive carriages. We do not know, whether this gentleman coincides with us in the opinion which

we have expressed, on the propelling of carriages upon ordinary roads; nor will the correctness of this opinion affect the value of his engine, as he does not expect to accomplish that which cannot be accomplished by steam, but to arrive at the same end, without carrying an equal load of machinery and fuel. Small portions of water and of spirits of turpentine, are converted into vapour by means of a lamp, which is the only fire used; these vapours, mixed with atmospheric air, form an explosive compound, the inflammation of which, produces a vacuum, which appears to be sufficiently perfect to secure a powerful re-action, from atmospheric pressure.

EDITOR.

Steam-Carriages.—As the subject of steam-carriages is of great public interest at the present moment, and as a considerable degree of misunderstanding prevails, respecting the origin and progress of this branch of practical mechanics, we propose, to give a slight chronological account of the inventions of those projectors, who have been, or are now, engaged in attempting to accomplish this important end.

In 1772, the late Oliver Evans, of Philadelphia, while apprentice to a wheelwright, first conceived the idea of propelling land-carriages without employing animal power. All the modes that have since been tried, such as the wind, treadles with ratchet wheels, cranks, &c., to be worked by men, were considered too futile by him to deserve a trial; by some subsequent experiment with steam, by a high pressure, he was convinced that he had discovered a suitable power; upon which he renewed his studies with increased ardour, and soon declared that he could make steam-wagons. This assertion drew upon him the ridicule of his associates; but, convinced of its feasibility himself, he maintained his position, and confirmed it by numerous experiments.

In 1786, he petitioned the legislature of Pennsylvania, for the exclusive right to use his improvements in the steam engine, in the construction of steam mills and steam wagons; the committee to whom the subject was referred, considered him insane, as regarded the latter proposition, and granted only the former. A similar petition to the state of Maryland was, however, successful in both points, owing to the good sense of the members of the committee, who urged that the grant could injure no one—that it might produce something good. These reasons obtained a grant to Oliver Evans, in May, 1787, for fourteen years. An interesting account of this ingenious man's improvements in the steam engine, and his experiments with steam wagons, is given in "Galloway's History of the Steam Engine," pp. 94. 101.

The public mind, both in England and America, was not at that time adapted for the encouragement of such an undertaking, and Mr. Evans' pecuniary resources were inadequate to overcome the obstacles which he met with in his proceedings, although the public trials made in Philadelphia of his steam wagons afforded demonstrative proofs to scientific men of their economy, and of the practicability of their construction; but no capitalist was found disposed to advance

the requisite sum for carrying the proposition into full effect. Mr. Evans being at the same time successful in the application of his admirable high pressure steam engine to propel boats, mills, &c., the steam wagons were laid aside for a more convenient and propitious opportunity.

In 1802, Messrs. Trevithick and Vivian proposed to adapt their high pressure engine to propel carriages on the common road; the form of their carriage resembled the common stage coach. The cylinder and boiler in a horizontal position were placed behind the carriage, and made to vibrate on pivots, so as to follow the revolution of the crank.

In 1804, Messrs. Trevithick and Vivian's loco-motive engine was successfully applied to the Merthyr Tydvil rail-road, South Wales.

In 1811, some improvements upon Trevithick and Vivian's plans were introduced by Mr. Blenkinsopp, of Middleton Colliery, near Leeds.

In 1813, Mr. William Brunton, of Butterly iron works, took out a patent for a loco-motive machine, in which were first introduced the propellers, in imitation of the action of horses' legs, and feet. This contrivance was materially improved upon by Mr. David Gordon, and was subsequently adopted by Mr. Gurney, with but little variation.

In 1814, Mr. Thomas Tudal, of York, took out patents for improved steam-carriages.

In 1814, Messrs. Dodd and Stephenson, introduced their patent improvements, which resembled Trevithick's, with respect to the contact of surfaces to obtain propulsion.

In 1816, Messrs. Loch and Stevenson took out patents for further improvements, which consisted in a mode of supporting the weight of the engine and machinery supportable on pistons, moveable in vertical cylinders, filled with steam, which acted as springs possessing the nicest elasticity.

In 1821, Mr. Julius Griffith, of Brompton, Middlesex, patented a new and very ingenious arrangement for a loco-motive carriage; it was the first, in which the engine and machinery were placed upon springs.

In 1823, Mr. Samuel Brown applied his gas vacuum engine to the propulsion of a carriage, which has made several public experiments.

In the same year, Mr. James, sen. patented some new contrivances, applied to loco-motive carriages, or rail-ways.

In 1824, Mr. W. H. James introduced some valuable improvements, and subsequently an excellent boiler and propelling machinery.

In the same year, Mr. David Gordon, patented his new arrangements for a steam-carriage.

In 1825, Messrs. Burstall and Hill, of Southwark, produced their first loco-motive carriage.

In the same year, Major M'Curdy applied his steam apparatus to a carriage for the common road.

In 1826, Mr. Gurney commenced the application of his patent steam generating apparatus to loco-motive purposes.

In the same year, Messrs. Burstall and Hill, took out their second patent for further improvements; a carriage, according to which, is built, and is undergoing alterations from time to time, as suggested by repeated experiments.

In the present year, Mr. James Neville, of Shad, Thames, has undertaken, and patented, a peculiar construction of loco-motive steam-carriages.

Also this year, Mr. Frederick Andrews, of Stanford Rivers, Essex, a new patent invention for a similar object.

There are now building, or altering, in London only, the following steam-carriages, of different constructions:—Gordon's, James's, Gurney's, Burstall's, Brown's, Hancock's, (of Stratford, not mentioned before,) also Beale's, (Commercial road, not mentioned before,) besides several others, respecting which our information must at present remain private.

It is likewise to be observed, that the preceding list of loco-motive projectors, falls far short of the whole of them; they include only such as occurred to our memory, or, were of easy reference to us. Our readers may be assured of our giving them the earliest intelligence, of whatever experiments of importance, may take place, among those horseless charioteers, and that their vehicles shall be all faithfully described and registered by us. [*Register of Arts.*

On the blowing of Air into furnaces, by a fall of water. By the late William Lewis, M. D.*

The earliest method of animating the large fires of the furnaces for melting ores, appears to have been by exposing them to the wind. Such was the practice of the Indians of Peru before the arrival of the Spaniards in that country. Alonso Barba relates, that their furnaces, called guairas, were built on eminences, where the air was freest; that they were perforated on all sides with holes, through which the air was driven in, when the wind blew, which was the only time the work could be carried on; that under each hole was made a projection of the stone work on the outside, and that on these projections were laid burning coals to heat the air, before its entrance into the furnace. Some authors speak of thousands of these guairas burning at once, on the sides and tops of the hills of Potosi.

I have been informed, that several remains of a like rude process are to be seen in some parts of our own country. The old bloomery-hearths, as they are called, for running down of iron ore, are all on the tops of hills; a situation which can scarcely be supposed to have

* To this account, we shall hereafter add the more recent plans for obtaining the same end. Editor.

been chosen on any other account than for the conveniency of the wind, being in other respects extremely incommodious.

The gradual succession of bellows, to this precarious and insufficient way of supplying air, and the gradual improvements made in the structure and manner of working of the bellows, cannot, perhaps, be traced. It appears, that at some of our iron furnaces, and others, the bellows were formerly moved by a handle, as those of the smith's forge, or by the pressure of the foot upon a treadle, or by other means requiring the strength of men: and that, since the force of water has been called in aid, to move them, the quantity of ore run down has not only been far greater, but the separation of the metal more complete; insomuch, that great part of the iron now (1763) prepared at some considerable works, particularly in the county of Gloucester, is no other than what had been formerly left in the slags or cinders for want of sufficient force of air.

The bellows used at our furnaces are composed of two boards joined by leather, nearly in the same manner as the common bellows. A cheaper kind of bellows, made entirely of wood, was introduced at the furnaces of the Hartz forest in Germany, according to Schluter, about the year 1620, and has since been received in Sweden, and some parts of France. It consists of two long boxes of the same figure with the smith's bellows, one of which drops over the other, and is of such a depth, that when raised upon a hinge, as high as it is intended to be, it no where comes entirely off: the air enters by a valve, as in other bellows, and is forced out by pressing down the upper box: along the edges of the lower, or inner box, are placed laths, which slide horizontally in grooves, and to which are fitted springs, capable of pressing them an inch or two beyond the box, so as to form a ledge, of variable width, which always accommodates itself to the outer box, and in great measure prevents the air from escaping between them.

Though the wooden bellows have an advantage above the leather ones of being less expensive and more durable, they have considerable defects; for it is scarcely possible to make the junctures so tight, as to allow no exit to the compressed air, and the friction must necessarily be very great. Some have therefore had recourse to water, for doing the office of the under board of the bellows. A bellows on this principle, is described in the Philosophical Transactions, and I have been favoured with descriptions and drawings of two singular ones, now used at some of the iron works in this kingdom, one for the finery, and the other for a large iron furnace, in which the fuel is coke, and which requires the greatest force of air of any known kind of furnace.

There is another method of applying water, so as to produce a strong blast, by means more simple than any of the foregoing, and at little expense. A stream of water, falling through a pipe, in certain circumstances, carries air down with it: and this air afterwards disengaged from the water at the bottom, may be so collected, as to have no other vent, than a pipe which shall carry it to the furnace.

Machines constructed on this foundation, though little known

among us, are used in different countries, instead of bellows, for animating the large furnaces. But their structure and principles of action have hitherto so little undergone a scientific examination, that those which have been found to answer the best, may be presumed to owe their excellence merely to chance, and that the workmen have often laid the greatest stress upon the proportions of parts which are inessential. These machines are, doubtless, capable of being much improved, so as to produce greater effects with a less quantity, and, what is of more consequence, with a less fall of water; and principles, may, doubtless, be discovered, by which their structure may be regulated and their power ascertained.

The importance of procuring commodious and cheap means of supplying the vast quantities of air, which the smelting furnaces require, induced me to examine the several accounts that have been published *of these simple substitutes for bellows:* and to make sundry experiments for bringing them nearer to perfection, and for establishing their laws of action.

An account of the principal Machines for blowing Air into Furnaces by a Fall of Water.

I. *A simple pipe.*—The first account I have met with of a machine for propelling air into furnaces by a fall of water, carrying down air with it, is of one at the copper or brass furnaces at Tivoli, near Rome, of which a description and figure are given in the third number of the Philosophical Transactions, and in the *Journal des Scavans*, for the year 1666.

A square wooden pipe, of considerable width, and open at both ends, is placed upright. A stream of water runs in at the top, and is discharged at the bottom; and at about the middle of the height of the pipe, a smaller horizontal one is inserted, which reaches to the furnace, and is said to convey to it a strong blast of air.

From so imperfect a description, we can learn little of the nature of the machine, or of the manner in which the blast is produced. It may be presumed, that the water, running forcibly against the side of the pipe, as it appears to do in the figure, is, in great part, dashed into drops; the intervals between which being filled by air, this air is successively pushed down, by the drops which follow, and afterwards escapes, as soon as it meets with a vent. There seems, however, to be some inaccuracy in the description, or some essential part omitted; for in such trials as I have made, when air thus conveyed into a perpendicular pipe along with running water, was discharged by a lateral aperture, part of the water always accompanied it in a stream; and more of the water seemed to issue out, in proportion as the quantity of air introduced was the greater.

II. *A pipe, with air-holes, inserted into an air-vessel.*—M. Belidor, in his *Architecture Hydraulique*, gives a more particular description of a water machine, used in some parts of France: he says there are four or five forges on the river Isere, between Romans and Grenoble, which have no other bellows.

• The stream is divided into two channels, and each division falls into an upright pipe, ten or twelve feet high. Near the tops of the pipes are several holes, made sloping downwards from the outside to the inside: through these holes air enters, and is carried down by the water; though the experiments in the following section will show that the quantity of air thus introduced, is not so great, as in the dispositions mentioned hereafter.

The essential difference of this instrument from the foregoing, consists in its having an air vessel, or reservoir for the air, at the bottom. An oval vessel near seven feet high, and three or four feet wide, is inverted, and its lower edge let into the ground, five or six inches. The lower ends of the two upright pipes enter into the top of the tub, and under each pipe is a kind of small stool, on which the water falls. The water, loaded with air, dashing against the stools with great velocity, rebounds, and its air is disengaged: a pipe communicating with the top of the tub, carries the air to the furnace, while the water runs out at a hole in the lower part; a sufficient height of water being kept in the tub, above this hole, to prevent any air from escaping by it.

III. *A funnel and pipe, without air-holes, inserted into an air-vessel.*—M. Marriotte, in his treatise *Du Mouvement des Eaux*, gives an account of another contrivance for blowing fire by a fall of water, which, Belidor says from the information of a friend, who travelled in Italy, is used in the Tiburtine mountain, near Rome, and near Salan, on the Lac de Guarde.

A wooden or tin pipe, fourteen or fifteen feet high, and one foot in diameter, has its lower end fixed into an air vessel, or inverted tub, as in the preceding section, from the one side of which a blast-pipe goes tapering to the furnace.

The upper end of the large upright pipe is contracted to an aperture of three or four inches, into which is fitted a funnel, whose neck exactly fills it. Into the funnel there falls a stream of water, from the height of ten, fifteen or twenty feet; which we may presume to be dashed into drops in its fall, and to push down air before it, on the same principle as in the machine of Tivoli, already mentioned.

This instrument promises to be more effectual than either of the preceding; though in this country it can be of little use, so high a fall of water being rarely to be procured, at least in those places where smelting furnaces are established.

IV. *A funnel and pipe, with air-holes, inserted into an air-vessel. —At Lead-hills, in Scotland.*—In No. 576 of the Philosophical Transactions, in the year 1745, Mr. Stirling describes a machine, erected in Scotland, for blowing air into furnaces in which lead ores are smelted; and for conveying fresh air into the works, so as to save the trouble and expense of the double drifts and shafts, and the cutting of communications between them.

A stream of water runs into a wooden funnel, so as to keep it always nearly full: the height of the funnel is five feet, and the diameter of its throat three inches and a half. The neck of the funnel

is inserted into an upright pipe, whose diameter is five inches and a half, and its length fourteen, fifteen, or sixteen feet: immediately under the throat of the funnel four air-holes are made in the pipe, at equal distances round it, about an inch and a half wide, sloping downwards from the outside to the inside.

The lower end of the pipe enters into a wooden tub, close at top, but without a bottom, six feet high and five and a half feet wide, sunk into a pit dug in the ground, and well rammed about with clay: in the middle of the tub, directly under the pipe, is a flat stone about two feet high, for the water to fall upon; and into the top of the tub is fixed a pipe for carrying off the air, communicating at the farther end with an iron one, which enters the furnace: for regulating the blast, a small hole is made in some convenient part of the pipe, which is stopped with a pin, or opened, according as the blast is required to be more or less strong. The hole in the lower part of the tub, by which the waste water passes out, is about five inches square; and one side of the pit, where the water runs off, is a little lower than the surface of the stone, so that the water can never rise high enough in the tub to cover the stone; though it is supposed to continue always a considerable height above the top of the hole.

Though this machine is said, in the Transactions, to be sufficient for the smelting of harder ore than any in Leadhills, where it was erected, I have been informed, by a person concerned in those works, that it has since been found not to answer so well as could be wished; and that accordingly it has been laid aside, and its place supplied by the bellows.

[TO BE CONTINUED.]

ACTIVE AND PASSIVE STRENGTH.

Active Strength, or Animal Energy, as of Men, Horses, &c.

[From Gregory's Mathematics for Practical Men.]

CONTINUED FROM PAGE 130.

8. In the first volume of my *Mechanics*, I stated the average force of a man at rest to be 70 lbs., and his utmost walking velocity, when unloaded, to be about 6 feet per second; and thence inferred that a man would produce the greatest momentum, when drawing $31\frac{1}{3}$ lbs. along a horizontal plane, with a velocity of 2 feet per second. But that is not the most advantageous way of applying human strength.

9. Dr. Desaguliers asserts, that a man can raise of water, or any other weight, about 550 lbs., or one hogshead, (weight of the vessel included,) 10 feet high in a minute; this statement, though he says it will hold good for 6 hours, appears from his own facts to be too high; and is certainly such as could not be continued one day after another. Mr. Smeaton considers this work as the effort of haste or distress; and reports that 6 good English labourers will be required, to raise 21141 cubic feet of sea-water to the height of four feet, in

four hours: in this case the men will raise a very little more than 6 cubic feet of fresh water each to the height of 10 feet in a minute. Now the hogshead containing about $8\frac{1}{2}$ cubic feet, Smeaton's allowance of work, proves less than that of Desaguliers', in the ratio of 6 to $8\frac{1}{2}$, or 3 to $4\frac{1}{4}$. And as his good English labourers who can work at this rate are estimated by him, to be equal to a double set of common men picked up at random, it seems proper to state that, with the probabilities of voluntary interruption, and other incidents, a man's work for several successive days ought not to be valued at more than half a hogshead raised 10 feet high in a minute. Smeaton likewise states that two ordinary horses will do the work in three hours and twenty minutes, which amounts to little more than two hogsheads and a half raised 10 feet high in a minute. So that, if these statements be accurate, one horse will do the work of five men.

Mr. Emerson affirms, that a man of ordinary strength, turning a roller by the handle, can act for a whole day against a resistance equal to 30 lbs. weight; and if he works 10 hours a day, he will raise a weight of 30 lbs. through $3\frac{1}{2}$ feet in a second of time; or, if the weight be greater, he will raise it to a proportionally less height. If two men work at a windlass, or roller, they can more easily draw up 70 lbs. than one man can 30 lbs.; provided the elbow of one of the handles be at right angles to that of the other. Men used to bear loads, such as porters, will carry from 150 lbs. to 200 or 250 lbs., according to their strength. A man cannot well draw more than 70 lbs. or 80 lbs. horizontally: and he cannot thrust with a greater force, acting horizontally at the height of his shoulders, than 27 or 30 lbs. But one of the most advantageous ways, in which a man can exert his force, is to sit and pull towards him, nearly horizontally, as in the action of rowing.

M. Coulomb communicated to the French National Institute, the results of various experiments on the quantity of action which men can afford by their daily work, according to the different manners in which they employ their strength. In the first place he examined the quantity of action which men can produce when, during a day, they mount a set of steps or stairs, either with or without a burthen. He found that the quanity of action of a man who mounts without a burthen, having only his own body to raise, is double that of a man loaded with a weight of 68 kilogrammes, or 150 lbs. avoirdupois, both continuing at work for a day. Hence it appears how much, with equal fatigue and time, the total or absolute effort may obtain different value by varying the combinations of effort and velocity.

But the word *effect* here denotes the total quantity of labour employed to raise, not only the burthen, but the man himself; and as Coulomb observes, what is of the greatest importance to consider is the *useful effect*, that is to say, the total effect, deducting the value which represents the transference of the weight of the man's body. This total effect is the greatest possible, when the man ascends without a burthen; but the *useful* effect is then nothing: it is also nothing if the man be so much loaded as to be scarcely capable of moving: and consequently, there exists between these two limits a value of

the load such that the useful effect is a maximum. M. Coulomb supposes that the loss of quantity of action is proportional to the load, (an hypothesis which experience confirms,) whence he obtains an equation which, treated according to the rules of maxima and minima, gives 53 kilogrammes, (117 lbs. avoird.) for the weight with which the man ought to be loaded, in order to produce during one day, by ascending stairs, the greatest useful effect: the quantity of action which results from this determination, has for its value, 56 kilogrammes, (123½ lbs. avoird.) raised through one kilometer, or nearly 1094 yards. But this method of working, is attended with a loss of three-fourths of the total action of men, and consequently, costs four times as much as work in which, after having mounted a set of steps without any burthen, the man should suffer himself to fall by any means, so as to raise a weight nearly equal to that of his own body.

From an examination of the work of men walking on a horizontal path, with or without a load, M. Coulomb concludes that the greatest quantity of action takes place when the men walk being loaded: and is to that of men walking under a load of 58 kilogrammes, (128 lbs. avoird.) nearly as 7 to 4. The weight which a man ought to carry in order to produce the greatest *useful effect*, namely, that effect in which the quantity of action relative to the carrying his own weight is deducted from the total effect, is 50·4 kilogrammes, or 111·18 lbs. avoirdupois.

There is a particular case which always obtains with respect to burthens carried in towns, viz. that in which the men, after having carried their load, return unloaded for a new burthen. The weight they should carry in this case, to produce the greatest effect, is 61·25 kilogrammes. (135⅛ lbs. avoird.) The quantity of useful action in this case, compared with that of a man, who walks freely and without a load, is nearly as 1 to 5, or in other words, he employs to pure loss, $\frac{4}{5}$ of his power. By causing a man to mount a set of steps freely and without burthen, his quantity of action is at least double of what he affords in any other method of employing his strength.

When men labour in cultivating the ground, the whole quantity afforded by one, during a day, amounts to 100 kilogrammes elevated to one kilometer, that is, 220·6 lbs. raised 1094 yards. M. Coulomb comparing this work with that of men employed to carry burthens up an ascent of steps, or at the pile-engine, finds a loss of about $\frac{1}{20}$ part only of the quantity of action, which may be neglected in researches of this kind.

In estimating mean results, we should not determine from experiments of short duration, nor should we make any deductions from the exertions of men of more than ordinary strength. The mean results have likewise a relation to climate. "I have caused," says M. Coulomb, "extensive works to be executed by the troops at Martinico, where the thermometer (of Reaumur) is seldom lower than 20° (77° of Fahrenheit). I have executed works of the same kind by the troops in France: and I can affirm that under the fourteenth degree of latitude, where men are almost always covered with perspi-

ration, they are not capable of performing half the work they could perform in our climate."

10. Entirely according with these are the experiments of Regnier, by means of a Dynamometer, the results of which, not only establish the superiority of civilized men over savages, but that of the Englishman over the Frenchman. The following is reduced from one of Regnier's tables of mean results.

STRENGTH.	With the hands.		With the reins.	
	lbs.	oz.	lbs.	oz.
Savages, of Van Dieman's Land	80	6	0	0
——— New Holland	51	8	14	8
——— Timor	58	7	16	2
Civilized men: French	69	2	22	1
——— English	71	4	23	8

11. A porter in London is accustomed to carry a burthen of 200 lbs., at the rate of three miles an hour: and a couple of chairmen continue at the pace of four miles an hour, under a load of 300 lbs. Yet these exertions, Professor Leslie remarks, are greatly inferior to the subsultory labour performed by porters in Turkey, the Levant, and generally on the shores of the Mediterranean. At Constantinople, an Albanian porter will carry 800 or 900 lbs. on his back, stooping forward, and assisting his steps by a short staff. Such loads, however, are carried for very short intervals. At Marseilles, it is affirmed that four porters carry the immense load of nearly two tons, by means of soft hods passing over their heads, and resting on their shoulders, with the ends of poles, from which the goods are suspended.

12. With regard to the magnitude of the comparative efforts of man in different employments, the late Mr. Robertson Buchanan ascertained, that in working a pump, in turning a winch, in ringing a bell, and rowing a boat, the Dynamic results are as the numbers 100, 167, 227, and 248.

According to the interesting experiments described in M. Hachette's *Traité des Machines*, the dynamic unit being *the weight of a cubic metre of water raised to the height of one metre*, [that is, 2208 lbs. avoird., or 4 hogsheads raised to the height of 3·281 feet, or 1·3124 hogsheads to the height of 10 feet,] we have the following measures, at a medium, of the daily actions of men.

	Dyn. Unit.
1. A man marching 7½ hours on a slope of 7 degrees, with a load of from 15 to 18 lbs.	225
2. Marching in a mountainous country without load	140
3. Carrier of wood up a ladder, his weight 123, his load 117 lbs.	109

	Dyn. Unit.
4. Carrier of peat up steps, his own weight comprised, 112 to	120
5. Man working at the cord of a pulley to raise the ram of a pile engine: three examples	75 40 48
6. A man drawing water from a well by means of a cord	71
7. Man working at a capstan	116
8. Man working at a capstan to raise water, mean of 24	110

The unit of transport being the weight of a cubic metre of water, carried a metre (2208 lbs. 3·281 feet) upon a horizontal road, we have for the daily action.

	Dyn. Unit.
1. A man travelling without load on a flat road, his weight 154 lbs., his journey 31¼ miles	3500
2. A soldier, carrying from 44 to 55 lbs., travelling 12½ miles, 1800 to	1900
3. Ditto, a forced march of 25 miles	2800
4. A French coal-porter, weight of the man not included, 792 to	880
5. Porter with wheel-barrow, weight of the man not included	1015
6. Porters with a sledge	627
7. A man drawing a boat on a canal; 110310 lbs. conveyed 6⅞ miles	550000

14. Mr. *B. Bevan*, an able engineer, has made experiments on the application of human energy to the use of augers, gimblets, screw-drivers, &c. He has presented to the public, the following list, as a specimen; premising that many ordinary operations are performed in a short space of time, and may therefore be done by greater exertion than if a longer time was necessary. Thus a person, for a short time, is able to use a tool, or instrument, called

	lbs.
A drawing-knife, with a force of	100
An auger, with two hands	100
A screw-driver, one hand	84
A common bench vice handle	72
A chisel and awl, vertical pressure	72
A windlass, handle revolving	60
Pincers and pliers, compression	60
A hand-plane, horizontally	50
A hand or thumb-vice	45
A hand-saw	36
A stock-bit, revolving	16
Small screw-drivers, or twisting by the thumb and fore-finger, only	14

15. M. Morisot, informs us that the time employed by a French stone mason's sawyer, to make a section of a square toise, (40·89 sq. feet Eng.) in different stones, is as follows: viz.

	hours.
Calcareous stone, equal grain, spec. grav. 2200	45
——— hard, spec. grav. 2300	62
Liais, ditto, hard, fine grain, spec. grav. 2400	67
Pyrenean alabaster, the softest of the marbles	56
Normandy granite	504
Granite from Vosges	700
Red and green porphyry	1177

The workmen ordinarily made 50 oscillations in a minute; each stroke about 15¾ inches.

16. Hassenfratz assigns 13 kilogrammes as the mean effort of such a man; but M. Navier, in his new edition of *Belidor, Architecture Hydraulique*, regards this estimate as too high. If this were correct, the daily quantity of action of the sawyer, would be equivalent to 376 kilogrammes, elevated to a kilometre, (818 lbs. raised ⅝ of a mile,) a quantity more than triple that of a man working at a winch. M. Navier gives, as a more correct measure of this labour for 12 hours, 188 kilogrammes raised a kilometre: half the former measure. But all this is probably very vague.

[TO BE CONTINUED.]

Account of some of the Processes in the Manufacture of Edge Tools, and other Steel Instruments. *By* SAMUEL PARKES, F. L. S. &c. [*Abstracted from Chemical Essays.*]

IN the manufacture of edge tools, the process which immediately succeeds the forging, is that of *hardening*. All these cutting instruments are therefore fashioned when the metal is in its originally soft state; and when they have attained the intended forms, they are heated afresh, to a particular temperature, suitable to the article. When they have acquired that degree of heat, they are instantly plunged into cold water, which gives them great hardness, and renders them capable of cutting soft iron, or even steel.

The best cutlers have ascertained, that it is always desirable not to give an instrument a greater degree of heat, by this operation, than is absolutely necessary; but this will be better understood as we proceed in describing that process.

Nothing augments the hardness of steel but increasing the *coldness* of the water; and hence some have had recourse to the solution of salts in the water to be employed in hardening. A stream of running water will make steel harder than *still* water, as fresh portions of the same fluid are incessantly presented to the heated metal. Some cutlers have assured me that they can make the best instruments, when they employ urine in the process of hardening. May not this be attributable to the phosphoric salts contained therein, as it has been demonstrated that phosphorus is one of the component parts of steel?

Experience has proved, that instruments which are the hardest, acquire the keenest edge, and are the most capable of cutting; but then a great degree of hardness always occasions the metal to be brittle; and when the edge is very fine, such instruments are useless for dividing hard substances, because the sharp part is not tenacious enough to endure the operation without snapping asunder. It is necessary, therefore, to be content with less hardness, in order to obtain the requisite tenacity, and this is effected by the operation called *tempering*.

Hence, when an instrument has been properly hardened, it must be softened again in some measure, or to that degree, which is thought to be most suitable for that particular purpose for which it is intended. To effect this, it is heated again only to a certain point, which is usually determined by the colour which the metal assumes, and then it is instantly plunged into cold water. This is called letting it down to the proper temper.

In France it has been the practice, in hardening small steel instruments, to cover them with soft soap, and then to roll them in common salt. This treatment prevents the articles from scaling, and does not prevent the hardening. The salt fluxes to a glass which covers the metal and protects it from oxidizement.

Pliny informs us, that in his time, the more delicate iron instruments were steeped in oil to quench them, lest they should grow too hard and brittle with water. On the contrary, Jonston says, that "if iron be plunged in vinegar it will endure no hammering, but will sooner break than draw." The Lacedæmonians, who made their coins of iron rods, were used to steep them in vinegar when red hot, that, being thus rendered brittle, they might never be put to any other use.

Here I should be guilty of great injustice, if I were to omit to notice the improvements in softening and hardening iron and steel, which have been discovered by Messrs. Perkins and Fairman, of London, and employed by them in preparing steel plates on which they engrave bankers' notes.

The usual mode of ascertaining the temperature to which any edge tool has arrived, is by attending during the operation to the shades of *colour*, which, as the metal becomes more and more heated, the bright parts assume in rotation, and then when it has acquired that particular hue which may be desired, removing it from the fire into water. But the nature of the operation is such, that this must always be attended with some uncertainty, especially as different tools require different management in the process, and it is often a very uncertain task to give the same temperature to every part of the same instrument.

It was on account of these, and some other difficulties, which the makers of edge tools constantly labour under, that I was induced to turn my attention to the subject, trusting that I should be enabled to suggest to the unscientific cutler, some improvement in this most important, though very uncertain branch of the art. But, in order that the reader may be better able to appreciate what I have to pro-

pose, I shall first show what particular colours are usually required for the tempering of a few of the instruments which are most in demand, and then explain some of the methods now practised for the attainment of some peculiar purposes.

In tempering edge tools, the first colour, which appears at 430° of Fahrenheit, is very pale and only a little inclining to the *yellow;* this is the temperature at which lancets are usually tempered.

At a little higher temperature, say 450°, the pale *straw* colour appears, which is a heat suitable for the best razors and most of the surgical instruments. Then comes the *full yellow*, at 470°, which is proper for common razors, penknives, and some other implements of surgery.

By increasing the temperature to 490°, the *brown* colour will be produced, which is generally looked for by those who have to temper garden-hoes,* small shears, and scissors, and all those chisels which are designed for cutting *cold* iron. Then at 510° comes the brown, dappled with *purple spots*, which shows the proper heat for tempering axes, firmer chisels, plane-irons, and pocket-knives. The next colour in succession is the *purple*, at 530°, the heat at which table-knives and large shears are usually tempered. The next is the *bright blue*, at 550°, which will give a proper temper to swords, watch-springs, springs for trusses, bell-springs, &c. Then comes the *full blue*, at 560°, which being the highest spring temper, is usually employed for small fine saws, daggers, augers, &c. This is the proper heat, also, for tempering most of those instruments which require to be elastic. The last degree in succession is the *dark blue*, approaching to black, which shows itself at 600°, and is the softest of all the gradations of temper, when the metal becomes suitable to few other instruments than hand and pit saws, which are necessarily made very soft in the first instance, that the workmen may be able to file them up, and set them, whenever they find occasion for it, without being obliged to soften them every time that operation is to be performed. This great heat is likewise employed in tempering some particular kinds of springs.

Some curious facts respecting the properties of *blued steel*, are related by Mr. Nicholson, on the testimony of Mr. Stodart, who says, "that he has found the spring, or elasticity, of the steel to be greatly impaired by taking off the blue with sand-paper, or otherwise; and, what is still more striking, that it may be restored again by the bluing process, without any previous hardening, or other additional treatment."

Extraordinary as these facts may appear, they have been fully confirmed by a manufacturer of Sheffield, who signs T. B. (probably Mr. Boulsover) and who writes thus:—"I took," says he, "a steel plate 30 inches long, 12 broad, and about ,04 thick; I hardened it in a composition of oil and tallow, and afterwards tempered it down to a spring temper; it was now so elastic as to recover its position

* Some workmen prefer 460°, or 470°, for garden-hoes, and such like implements.

after being bended—by hammering it to set it straight, it lost a part of its elasticity; after being ground in the same manner as a saw, the elasticity became still less, having nearly returned to the same state as before hardened:—it was then very uniformly heated until it became blue; it now recovered the whole of its elasticity:—after being glazed bright upon a glazer coated with emery, the elasticity was found to be impaired, but in a less degree than when it was ground; the same effect was also produced by rubbing with emery or sand-paper, and also by burnishing; invariably the elasticity was recovered by bluing, and hence this is always the last operation in the manufacture of elastic steel plate.

Every maker of edge tools well knows that their temper is indicated by the colour which they assume; thus by observing the progress of the colour, he is guided in operating on the different kinds of instruments, experience alone being the rule in these cases; but in order to obtain the most favourable results in some instances of nicety, there are other minutiæ which require much care and observation.

[TO BE CONTINUED.]

On some properties of Iron in its different states, and under particular circumstances. By M. PAJOT DESCHARMES.

Translated for this Journal.

MORTAR, OR CEMENT FOR STONE.

THERE is a species of tritoxide of iron, which is of a violet brown colour, impalpable, and of a brilliant micaceous appearance, which results from the decomposition of muriate of soda, (common salt,) by the action of sulphate of iron, (copperas,) assisted by heat. If this be mixed with quick-lime, and sand, with a sufficient quantity of common water, to bring the whole to a pasty consistence, on applying the composition to two stones which it is wished to unite, this mortar quickly becomes so hard and strong, that the two pieces will be so firmly cemented, as to appear to form but one body.

Remarks by the Editor.—To obtain the oxide (rust) of iron for the above purpose, all that is necessary, is to dissolve about equal quantities of common salt, and copperas, in separate portions of water, and to pour them together at a boiling heat, when the powder in question will be precipitated. The clear liquor may then be poured off, the precipitate washed, and it is fit for use.

Effect of time, in combining the oxide of Iron with earths.

About the beginning of the present century, I found a flat plate of iron, on the floor of an ancient Druidical temple, which I discovered in the forest of Saint Gobin; by means of the water which had filtrated through the mass of clay and sand, with which the iron was covered, a re-action had taken place, which rendered it extremely difficult, even with the assistance of a proper instrument, to detach any portion of the agglomerated mass.

Glass house cinders, employed in hydraulic mortar.

When the bridge of Louis XVI. was constructed, much advantage was derived from mixing with the hydraulic mortar which was used, a portion of the *escarbilles*, more or less ferruginous, which had passed the grating of the glass bottle furnace, at Meudon, near Sèvres. These *escarbilles* were pulverized, and introduced into the mortar used, and contributed to its rapid consolidation. The same benefits were experienced when the jetties and fort at Cherbourg were built; the *escarbilles*, having been obtained from the glass house of Tour-Laville, about a league and a half distant from that port.

Remarks.—The word *escarbilles*, used in the above article, we have not translated, but the English term cinders, we believe, expresses the idea with perfect precision; the French word *cendres*, means ashes only, and we do not know of any popular term in that language, corresponding to cinders, in English; the term *escarbille* is used technically only. The *Dictionnaire Technologique*, says, "this name is given in the manufactories, to those portions of the coal, which escape complete combustion, and which are mixed with the ashes. This is, a sort of coke, more or less light, and in small pieces." In these furnaces it is to be understood that pit-coal is employed.

EDITOR.

Improved paving mortar.

It is well known that the mortar used for paving quays, the yards of hotels, or other buildings, is greatly improved by being mixed with the residuum from the distillation of aqua-fortis, when baked ferruginous clay is used for the decomposition of the nitre.

Coal ashes rendering mortar water-proof.

A similar effect is produced in coal mines, when it is necessary to prevent the infiltration of water between the joinings of timbers; for this purpose the space between the earth, and the timbers, is filled with a mortar, made of lime, and the ashes of the coal, which is always ferruginous.

Cast-iron balls combining with sand.

I have seen on the sea-shore, near Cherbourg, a small ball, and a twenty-four pounder, both of cast-iron, the affinity of which had been exerted with such power, upon the sand, and the calcareous particles, accompanying it, upon which these projectiles had been rolled by the flux and reflux of the tide, that the small ball had become as large as a twenty-four pounder, and the larger one equal in size to the largest bomb-shells. The substances which were thus agglutinated had formed a mass so hard, that a pointed chisel was requisite to separate small portions of it.

Malleable Iron and Lead fused under Glass.

Malleable iron, (in the form of a nail,) and metallic lead, melted together, under glass, with an alkaline flux, appear to exert a cer-

tain action upon each other; for I have found them at the bottom of the crucible, the one incrusted by the other, and very adherent; the globule of iron was in part encased by the earth of the crucible, and the globule of lead, contained in a cavity which it had formed in the upper surface of the iron; the latter was striated on its exterior; the lead and the iron might sometimes be separated, but in general, this could not be effected.

Glass, coloured blue, by Iron.

The tritoxide of iron, formerly mentioned, mixed with sulphate of soda, and sub-carbonate of soda, give to the glass which this mixture produces, a blue colour resembling that observed when similar materials are exposed to a partial fusion, and which, in a length of time, form on the surface, about the sides, or in the backs of hearths, both of brick and of stone in reverberatory furnaces, used for the decomposition of muriate of soda, by the sulphate of iron. My observations on this production of colour, were first made about the year 1800, when I had the direction of the glass works at Tour-Laville, and was decomposing the muriate of soda, by sulphate of iron.

I have thought that these several observations which have been made by me at different periods of time, might, if published, lead to important results, and particularly the two last, in the making of ultra-marine.

On the Parolic Cement. *By* THOMAS GILL, ESQ.

THIS cement, which is termed *Parolic*, or *Universal*, from the great variety of purposes to which it is applicable, is of the class of those termed *caseous;* the curd of milk forming the principal part of its composition. It was invented by me in the year 1811; and a considerable quantity of it has since been made and sold by Mr. J. J. Hawkins, under the above title; but the composition of it has hitherto remained a secret to the public. It will perhaps be a convincing proof of its merits, to say that it is a complete substitute for the celebrated *Vancouver's Cement*, now in such universal demand.

To prepare this cement, take the unsalted curd of skimmed milk, after pressing the whey out of it, and break it into lumps: to dry these lumps distribute them upon linen sheets laid upon the floor of an airy room; and frequently, from time to time, as the curd acquires greater consistency, stir and break it into smaller masses, either with the hands, or with the assistance of a flat board, and a bar or rubber of wood; until at length it becomes dry enough to grind in a steel coffee-mill, to a powder about as fine as the best gunpowder; when it must be finally dried over a stove, and kept dry for use.

One hundred pounds of curd, from the cheese-press, will only afford about thirty pounds of the dry curd.

To ninety parts of this dried curd, ten parts of caustic quick-lime, made of blue marble, finely rubbed to powder and searced, and one part of camphor, must be added, and well mixed by rubbing the

whole together with a pallet-knife upon a stone slab; and the whole must be then inclosed in bottles, holding about an ounce each; and well corked immediately afterwards, in order to prevent the access of air to the composition.

In this state the cement will remain good a long time; and, when wanted for use, a little of it must be poured out upon any flat earthen plate, &c. and, by the aid of a pallet or case-knife, be instantly mixed with a proper quantity of water, to render it of a fit consistency for the purpose to which it is to be applied.

The bottle must be again carefully closed, after taking out the quantity of cement required; as, otherwise, the lime would lose its causticity, upon which its solvent action on the caseous part of the cement entirely depends. [*Tech. Rep.*

Process by which Seal Engravers take their beautiful wax Impressions.

To the Editor of the London Mechanics' Magazine.

Sir,—In answer to a request of a correspondent, to be informed how engravers take their wax impressions, I beg leave to give the following directions; they may be prolix, but as a good impression depends upon attention to minutiæ, I consider it requisite to be as particular as I can. In the first place, clean the engraving with soap and water, then prepare the stone as follows:—Take a little grease (very little is requisite,) and rub it thinly upon the back of the hand; then, with a fine brush, (a tooth-brush will do provided the hair is very soft,) take it off and brush the stone: there will be sufficient grease upon the stone for the vermilion to adhere to; only be careful not to smear it across, but dab the brush upon it perpendicularly, by which a surface is produced resembling a mezzotinto ground. Many of the engravers pay little attention to this part; but from experience I am well convinced, that unless the stone is properly greased, the surface of the impression will never appear to advantage. Now take a camel's-hair pencil, and dip it in Chinese vermilion; turn the brush upside down, and tap gently upon the table, so that the vermilion may fall into it and not lay upon the top, otherwise it will so clog up the work, that all its sharpness will be lost; apply it to the stone, holding it perpendicularly, to preserve a smooth regular surface; when that is done, blow off the superfluous colour, and proceed as follows. Cut a strip of stout paper to put your wax upon, which melt over a candle, holding it about half an inch from the flame, (be careful not to burn or smoke it;) keep turning it round, so that the stick of wax may be melted all round; when sufficiently so, put it upon the paper, and so on till there is a sufficient quantity: take the paper and hold it over the candle, and when soft, stir it round, and continue doing so till it is of the size necessary. Take it from the candle, and continue stirring till the surface is perfectly smooth and free from air bubbles; keep the greatest portion of wax in the middle,

so that there may be a good rim round the edge of the engraving: lay it down, and take up the seal (do not be hasty, it will continue hot some time,) and hold it over the candle, so that the flame just touches it. When sufficiently hot, (experience will be the best guide in this particular,)—nearly as hot as it can be borne upon the back of the hand will, perhaps, be the best guide—apply it to the wax, not hastily but steadily, holding the seal between the finger and thumb by the top: let it stand, pressing gently upon it till the wax is set, which may be told by pressing upon the edge with the nail; when it is so, put your fingers round the impression to keep it down, and pull the seal off. If the impression is good, the engraved parts will be dull; if otherwise, the work will be shining, in which case, the seal has been too cold. If the surface in the plain part is marked and rough, the seal has been too hot. Practice will soon enable you to avoid these defects. Let the wax be rather stiff than otherwise, before the seal is applied.

Your's obediently,

J. P.

Improved Gas for Illumination.

MR. HENRY PINKUS, of Philadelphia, has just obtained two patents for improvements in the methods of generating and purifying gas for illumination, upon which improved plans, a manufactory in London has been lighted up with complete success.

The gas afforded a clear and brilliant light, and was found to be wholly exempt from that fœtid odour, which has hitherto been found to emanate from gas in the most purified state in which it is furnished for consumption. We are not yet at liberty to make known the particulars of these improvements, as the Irish and Scotch patents, now in progress, are not yet sealed, but we anticipate that the public will be much benefitted by this invention, as gas-lights will, by these means, be afforded under circumstances of decidedly greater economy than has ever before been proposed.

Not the least important part of these improvements, is the simple method of purifying gas practised, and which, as far as we have yet seen, appears to be perfectly effective. It is well known, that gas in its crude state, contains portions of sulphuretted hydrogen, and carbonic acid, which, by the present system of purification adopted at the gas works, is not completely absorbed, and when burnt in close apartments, or in any considerable quantity, produces a suffocating odour, blackens paint, or tarnishes metallic substances, and causes head-ach, and other unpleasant feeling to the persons who breathe the atmosphere in its vicinity. These have been the great objections to the introduction of this desirable light into private houses, and the cause of its expulsion from many of the principal club-houses and hotels in this metropolis.

The patentee considers his method of purifying as entirely obviat-

ing these imperfections, and we have to our own satisfaction, witnessed that his gas is quite free from any unpleasant smell, even when allowed to escape unburned.

[*Newton's Journal.*

Mr. SAMUEL BROWN'S *reply to the remarks of Mr.* PERKINS, *on the subject of the Gas-Engine; in a letter to the Editor of the Times Newspaper, London.*

WE find the following letter in the *Repertory of Patent Inventions*, for December last, and we hasten to insert it, as the animadversions of which it complains, were addressed to, and published by us, and we are always desirous of affording an opportunity of defence, whenever a charge is made. The letter is preceded, in the Journal abovementioned, by an extract from the letter of Mr. Perkins, published in our number for June last, and containing the remarks to which Mr. Brown replies. The editor of the Repertory had inserted the communication of a correspondent, containing an opinion unfavourable to Mr. Brown's engine; and remarks, "we do not think Professor Millington's, and Dr. Birkbeck's opinions outweigh Mr. Perkins', and our correspondent's."

MR. BROWN'S LETTER.

"SIR—Some severe animadversions on, and I must add, ungenerous misrepresentations of, the principle and power of the vacuum engine invented by me, having appeared in your Journal of Thursday last, extracted from a letter written by Mr. Perkins, and published in an American paper, I trust you will allow me to reply to the observations and censures which have been thus widely circulated.

"Mr. Perkins boldly asserts that my invention 'has died a natural death;' for which assertion there is not the slightest foundation, my persevering and constant attention having enabled me to bring my engine to a state of perfection, nearly, if not quite, equal to the most sanguine expectations which have been formed regarding it.

"It is also stated, or rather predicted, by Mr. Perkins, that I never can succeed, because the principle of my invention is 'contrary to the order of nature.' To this I beg to reply, that one of the well understood principles of nature forms the basis on which the power of my engine is gained; viz:—the pressure of the atmosphere. I should occupy too much of your valuable paper, were I to enter into the details of the combination, and the mechanical operations by which the effect is produced, in reply to the ingenious and laboured, but ill-founded, remarks which Mr. Perkins makes to show that I do not gain any available power; but, I beg to state, with the confidence produced by long experience, that the power which I do actually gain, and can use without intermission, is at least equal to

the effective power produced by the best condensing steam-engine which has ever been constructed. This fact, more satisfactory than written assertions, I am ready to demonstrate, by actual proof, to any engineer or scientific man who has a wish, and a fair claim, to be so satisfied.

"As the opinion of Mr. Perkins against me, has been so decidedly expressed and published, I may be allowed to mention, that the opinions of many eminent persons have been as decidedly advanced in my favour; particularly those of two gentlemen who justly possess the confidence of the public—Professor Millington, and Dr. Birkbeck, who have lectured experimentally on the gas-engine, at the Royal and Mechanics' Institutions, and have calculated, demonstrated, and compared its power, economy, and advantages, with reference to Boulton and Watt's, and other steam-engines, the results being considered essentially in my favour. One or two of these lectures, entering into minute details, have, I believe, been published, and I presume may be purchased. To them I refer for the proof of my assertion.

"With respect to the economy of my engine, of which Mr. Perkins is also doubtful, I beg leave to observe that, having latterly turned much of my attention to the manufacture of gas at the cheapest possible rate, I trust I shall shortly be able to prove, to the satisfaction of the public, by actual demonstration, that the gas-engine may be worked, either for loco-motive or stationary purposes, at an expense which is far exceeded by that of any steam-engine in operation.

I am, sir, &c.

SAMUEL BROWN.

Eagle Lodge, Old Brompton, Nov. 10."

A method for taking an Impression from a copper-plate on Plaster of Paris, with ink, as in common prints.

LET the plate be filled with ink (made of the best ivory black, mixed with drying linseed oil, and ground very fine on a painter's stone) and the surface cleaned with the hand and whiting, as in common copper-plate printing. Provide yourself with a board about half an inch thick, just the size of your plate; round the edge of this, wrap some stiff paper, raised half an inch above the surface on one side, and level on the other, in the form of a trough: into this put your plate, with the prepared side upwards; then mix your Paris plaster with water, to a proper consistency, and pour it on the plate; then lifting up the trough, let it fall flat upon the table again, to drive the bubbles of air from the plate through the surface of the plaster; after you have repeated this about 12 times, let it stand an hour. Afterwards take the plate out of the trough, and the plaster,

now hardened, from the plate, and you will have a very neat impression on the plaster, fit to put in a frame, and by far preferable to the best prints.

[*London Mechanics' Mag.*

Method of taking Impressions of Medals or Coins.

TO THE EDITOR.

Sir—The following is a method of taking impressions of medals or coins with isinglass. Take an ounce of isinglass; beat it in a mortar; then pick it into small pieces, put them into a half pint phial, and then fill it up with a spirituous liquor, (common brandy or Geneva will do;) put a cork into the phial, with a notch cut in one side of it for a passage of air, and then set it by the fire for three or four hours, shaking it often in that time; (the heat should be great enough to keep it near boiling all the while.) The isinglass will then be sufficiently dissolved, and the whole must be put into a cloth, and strained off; it must finally be put into a clean phial, well corked, and kept for use.

When it is wanted for use, take the glue and set it by the fire, and it will soon liquify or become fluid; then having made the medal clean, and placed it quite level, pour on as much of the glue as will cover it completely over and lie without running off. It must then be allowed to dry, (which in the summer time and dry weather will require but one or two days,) when it is quite dry, it must be taken off by entering the point of a pen-knife under one side, and it will rise off the medal in a clear, transparent, and perfect resemblance of the whole, even the most minute parts of it.

I am yours, &c.

J. C.

[*ib.*

On an Economical Blower. By the Editor.

The blowers for grates in which anthracite is burned, are frequently troublesome and inconvenient, but a substitute may be found in a common newspaper, which will answer the purpose better than those of sheet-iron, whilst the same paper may be used repeatedly, and when destroyed is replaced without the assistance of the iron-worker. All that is necessary is to spread the sheet in front of the grate, confining it by the weight of the tongs upon the ledge above the grate, or in any other simple way. The draft of the chimney will cause it to fit close at every part, and it is evident, that the lower edge of the paper may be made to reach to any depth, upon the bars of the grate which may be thought best, and which should never be below that part where the fire burns brightly. The fire may be made to burn with great intensity without consuming the

paper, the exterior cool air pressing upon it, and keeping its temperature below the point of combustion. The use of this kind of blower was first mentioned to the Editor by Mr. Jesper Harding, two or three months ago, and since this period the old one of sheet iron has been allowed quietly to repose in its corner, and the hands of those who manage the fire (including all hands) have remained unscathed.

New Solar Compass.

At the last meeting of the Edinburgh Wernerian Society, a very interesting instrument was exhibited, the invention of Mark Watt, Esq. It may be thus briefly described:—twenty-five needles of the size of No. 10, are rendered magnetic, and stuck at equal distances, into a thin circular slice of cork, of three inches diameter; this circle is affixed by a copper wire to a light bar of wood, five inches long, having at its opposite extremity, a small weight equal to the weight of the needles. In the centre of the bar is an agate cap, which receives a fine steel point, on which the instrument traverses. Being secured from the action of the external air by a bell glass, and exposed to the influence of the sun's ray, the circle of magnetised needles points to the sun, and in that position, in opposition to the diurnal motions of the earth, as long as the sun is above the horizon.

Apparatus for Lubricating the Gudgeons of Mills, and the Pivots of other Machinery; invented by Mr. John Barton, *Engineer.*

This simple, and useful contrivance is described in a recent number of the *Technological Repository;* it consists of a vessel of tin, or other metal, to contain the oil, with a cover to protect it from dust; the bottom of this vessel, or cup, is perforated, and has a tube soldered in, and passing through it, which is open at both ends; the lower end of this tube is made to fit into a hole in the uppermost of the two brasses, within which the gudgeon or pivot revolves; the length of this tube is such as to rise above the oil, which is to be poured into the vessel, and by which it is, of course, surrounded. When the tube is inserted into the brass, a number of threads of woolen yarn are hung upon the tube, so that at one end they may dip into the oil, and by the other supply the quantity necessary for lubrication; this of course is regulated by the quantity of yarn used, and along which the oil will pass by capillary attraction, thus forming a syphon which will apply the oil to the bearings.

These vessels it is said have been extensively used in large works, and have been ordered for the machinery belonging to the government, at the dock-yard at Portsea.

AMERICAN PATENTS.

List of Patents granted in the United States, from August 24th, to November 13th, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

Improvement in plane stocks, of cast-iron; Hazard Knowles, of Colchester, New London County, Conn., August 24.

In the composition of liquor, to start the yolk, animal oil, or grease, which wool contains, when taken from the sheep; John Goulding, of Dedham, Massachusetts, August 24.

In the mode of manufacturing wool, or other fibrous material, in which, sliver, slubbing, or roping, is unwound, or delivered, on a mule spinning machine, or drawing frame; John Goulding, of Dedham, Massachusetts, August 24.

In the mode of scouring and washing all kinds of cloths; John Goulding, of Dedham, Massachusetts, August 24.

In the mode of throwing the shuttle, or shuttles, in weaving; John Goulding, of Dedham, Massachusetts, August 24.

In the washing machine, called the accelerating washer; Moses Cass, of Caroline, Tompkins County, New York, August 29.

In making aqueducts for conveying water or gas under ground, by means of a conductor, formed of water-proof lime, as a cement for stone, wood, or brick; John M. Benham, of Bridgewater, Oneida County, New York, August 29.

In the loom, for weaving all kinds of figured goods; Horace Baker, North Salem, West Chester County, New York, August 30.

In the art of distilling, by Aikin's improved rectifiers; John M. Aikin, Philadelphia, August 30.

In the use, combination, and construction of boats; Thomas Thorpe, City of Washington, District of Columbia, August 31.

In the saw, called the two edged saw; Moses Cass, and Aaron Bull, of Caroline, Tompkins County, New York, August 31.

In the machine for paying or filling the seams of ships, and other vessels, called a pitch syringe; Daniel Flint, of Nobleboro, Lincoln County, Maine, August 31.

In the hydraulic elevator; David Corey, of New York, August 31.

In the carding machine; John Tillon, of Newtown, Fairfield County, Conn., September 8.

In the machine for moulding brick, and tile; Ezra Fisk, and Benjamin Hinkley, of Fayette, Kennebeck County, Maine, September 8.

In the magazine percussion gun-lock; James B. Lowry, of Mayville, Chatauga County, New York, September 8.

In the machine for separating the hair, and other extraneous matter, from fur of various descriptions, to prepare it for hatters' use; John Macdonald, of the city of New York, September 11.

In the open single screw, or spiral water-wheel, called the open screw water-wheel, Elijah Skinner, of Sandwich, Stratford County, New Hampshire, September 11.

In the cast-iron mill, for grinding bark; William Torrey, of Westbrook, Cumberland County, State of Maine, September 13.

In the churn; Daniel Sheldon, of Pultney, Steuben County, New York, September 13.

In the machine called the propelling water paddle wheel; John James Giraud, of Baltimore, Md., September 18.

In the mode of tanning leather; Osmond Cogswell, of Cincinnati, Ohio, September 18.

In the hoe, called the *prong hoe;* Joseph Willson, of Marlborough, New Hampshire, September 20.

In Paul Hawe's machine, for making shingles; George A. Hoard, of Antwerp, Jefferson County, New York, September 20.

In the fanning mill; Enoch Walker, of Springville, Four Corners, Susquehanna County, Pennsylvania, September 20.

In the machine for cutting shingles; George W. Dana, of Lowville, Lewis County, New York, September 20.

In a vegetable composition, or matter, for preventing or curing the scurvy, and making catchup or catsup, and various sauces; James U. Armour, of Fredericktown, Frederick County, Md., September 28.

In Israel Johnson's, junr., patent saw mill; Anson B. Graham, of Lee, Berkshire County, Massachusetts, September 28.

In the washing machine; Franklin Kellsey, of Middletown, Conn., September 28.

In the apparatus for setting saw teeth, called a spring saw set; John Boggs, of Philadelphia, Oct. 4.

In the printing press; Samuel Couillard, of Boston, Oct. 5.

In the machine called a power gained lever; Edward G. Fitch, of Blakely, Baldwin County, Alabama, Oct. 5.

In the thrashing machine; Ebenezer B. Pike, of Litchfield, Maine, Oct. 5.

In the mode of making pressed glass knobs, for furniture, &c., at one operation; John Robinson, of Pittsburg, Pennsylvania, Oct. 6.

In the construction of a flexible rack, and manner of application, for operating on ships' carriages, or other carriages, used in the marine or other rail-ways; Jesse Wood, and Paul A. Sabbator, of New York, Oct. 6.

In hydraulics; Jacob Roup, of Kenhawa County, Virginia, Oct. 6.

In the cast-iron sled shoe, and cutter shoe; Edward Trask, Sangerfield, Oneida County, New York, Oct. 6.

In Dearborn's patent warehouse balance, so called, for weighing all kinds of substances, whether gross and ponderous, or light and delicate, called Blaisdel's improved avoirdupois balance; Samuel Blaisdel, of Lancaster, Fairfield County, Ohio, Oct. 10.

In the machine for mortising and tenoning timber; John M'Clintic, of Chambersburg, Pennsylvania, Oct. 8.

In the machine for making plastering laths; Thomas Wright, and Abraham P. Howell, of Cincinnati, Ohio, Oct. 9.

In the machine called the screw cradle, for raising ships, or vessels, of any size, or weight, entirely out of water, in order to repair, or for any use required; Charles Miner, of Lyme, Conn., Oct. 12.

In the lever percussion gun-lock; John Ambler, junr., of South New Berlin, Chenango County, New York, Oct. 16.

In the construction and use of moulds with a core, for pressing glass into various useful forms; called Dummer's scallop, or cover-plate; Phineas C. Dummer, of Jersey city, New Jersey, Oct. 16.

In forming glass by the combination of moulds with mechanical powers; George Dummer, Phineas C. Dummer, and James Maxwell, of Jersey city, New Jersey, Oct. 16.

In the vertical bucket or float wheel, for propelling boats; Stacy Costill, of Philadelphia, Oct. 17.

In a bobbin tube for spinning cotton; Benjamin Hutchinson, of Philadelphia, Oct. 18.

In propelling machinery by weights; Cain Broyles, of Tellico, Munro County, Tennessee, Oct. 19.

In the trip-hammer, propelled by the foot; Ebenezer Pierce, and Joseph Hathaway, of Pultney, Steuben County, New York, Oct. 19.

In the mode of heaving down vessels; John Crowninshield, of Salem, Massachusetts, Oct. 19.

In the mode of casting types, called the mechanical type caster; Stephen Sturdevant, and Edwin Starr, of Boston, Oct. 23.

In the water-proof stiffening for hats, called "Hempstead's improved stiffening, to water-proof and stiffen hats," his former patent for the same invention, dated on the 25th day of May, 1827, being cancelled on account of a defective specification, May 25th, 1827, re-issued; Stephen Hempstead, junr., of St. Charles County, Missouri, Oct. 26.

In the machine for cutting corks; George Rawlings, of Philadelphia, Oct. 30.

In the application of the scape heat from the furnace, and the discharged steam from the engine of the ordinary high pressure steam engine, to the manufacturing of coarse salt, from salt water; Alexander Brown, of Salina, New York, Oct. 30.

In making steel cylinders or mills, as they are commonly called, for the purpose of impressing figures or devices on copper rollers for calico printing, *by biting in the figures or devices on the steel cylinders, by means of acid*, the process which is usually called etching; David H. Mason, and Matthias W. Baldwin, of Philadelphia, October 30.

In distilling; William J. Cocke, of Surrey County, Virginia, October 30.

In the planing machine; Josiah Reihm, of Savage Factory, Maryland, November 1.

In the construction of clocks; Harrison G. Dyar, of New York, November 6.

In cast-iron, or other metal hubs, for wheels of carriages; Benjamin Lyman, of Manchester, Conn., November 6.

In the method of cleaning and polishing rice, coffee, and other grain; Elijah Wilder, of Jersey city, New Jersey, November 6.

In the mode of making or manufacturing machines, for cutting fur from skins, for hatters' use, called the cant twist blades fur cut-

ter; Charles C. K. Beach, of Portland, Cumberland County, Maine, November 10.

In the percussion gun-lock, with a magazine; Joseph Shattuck, of Jefferson County, Ohio, November 10.

In making moccasins water-proof; John Syms, of New York, November 10.

In the mode of letting water on water wheels; Michael Hildebrand, of M'Minn County, Tennessee, November 10.

In the retention or discharge of fluids, more particularly water; Bradford Seymour, of Westmoreland, Oneida County, New York, November 10.

In the musical instrument called the Kent bugle, which he denominates the harmonic pocket bugle; Richard Willis, of West Point, Orange County, New York, November 10.

In the machine for making shingles; Oliver Wheeler, Monroe County, New York, November 10.

In the mode of imitating all kinds of marble, for the fronts of houses, and perfecting and embellishing hard finished walls; Benjamin Trembley, of New York, November 13.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from the 11th of Oct. to the 20th of Nov. 1827.

To Joseph and Thomas Hall, braziers, for an improvement in the making and manufacturing of metallic blocks, for drawing off liquids —October 11.

To Elias Carter, upholsterer, for a new covering for the roofs of houses, and other buildings—October 11.

To Joshua Horton, boiler maker, for a new and improved method of forming and making hollow cylinders, guns, ordnance, retorts, and various other hollow and useful articles, in wrought iron, or in steel, or composed of both those metals—October 11.

To Goldsworthy Gurney, surgeon, for certain improvements in loco-motive engines, and the apparatus connected therewith—October 11.

To James Stokes, merchant, for improvements in making, boiling, burning, clarifying, or preparing raw or muscovado bastard sugar and molasses—October 11.

To John Wright, engineer, for improvements in window sashes—October 11.

To James Smethurst, lamp manufacturer, for an improvement or improvements upon lamps—November 6.

To Frederick Foveaux Weiss, surgical instrument maker, for his invention of certain improvements in the construction of spurs—November 6.

To James White, engineer, for his invention of a machine or ap-

paratus for filtering, which he denominates an artificial spring—November 8.

To John Platt, fustian dresser, by virtue of certain communications made to him by a foreigner residing abroad, for an invention of which he is in possession, of certain improvements in machinery for combing wool and other fibrous materials—November 10.

To William Collier, fustian shearer, in consequence of certain communications made to him by a foreigner residing abroad, for an invention of certain improvements in the power loom for weaving—November 10.

To John Walker, esq., for his invention of an improved castor for furniture—November 17.

To Henry Pinkus, of the city of Philadelphia, in the State of Pennsylvania, in the United States of America, gentleman, for his having invented, or found out, an improved method of purifying carburetted hydrogen gas, for the purposes of illumination—November 17.

To Mr. Samuel Sevill, clothier, for his invention of certain improvements applicable to raising the pile and dressing woolen and other cloths—November 20.

FRENCH PATENTS.

List of Patents granted by the French Government, from the 1st of April, to the 30th of June, 1827.

[CONCLUDED FROM PAGE 144.]

To M. Poyenar, Paris, for a portable pen, which supplies itself with ink—5 years.

Messrs. Risler and Dixon, of Cernay, for a loom, called the metier dixon—5 years.

Messrs. Vesin, of Cessieux, and Devannes, of Cherbourg, for a system of inclined planes suitable instead of sluices, in navigating rivers and canals—10 years.

Jean Numa Anverny, and Augustin Ginaux, of Montpellier, for a machine for making and cutting corks—5 years.

Timothy Burstall, of Leith, for an apparatus called a loco-moteur, adapted to steam carriages, and improvements in supplying boilers with water for steam—15 years.

Richard Laurent, Lieutenant in the French Navy, for a process for enabling laden craft to come up rapid rivers, by the rapidity of the current itself—15 years.

Louis Scheriz, of Strasbourg, for a process for raising silk-worms upon vegetables, without mulberry leaves, and for a method of cleaning and enlarging their beds—15 years.

Isaac Winslow, of Havre, for a machine for spinning cotton without twisting, called the rotta flotteur; ou fileur en doux economique et expeditif—5 years.

John Jones, of Leeds, for an apparatus for brushing cloths and other stuffs—10 years.

Michel Lorillard, locksmith, for a machine for preparing flax and hemp—15 years.

Jacques Augustin Gaubert, of Montpellier, for a method of procuring salt and cream of tartar, from the skins of grapes, after they have been pressed for making wine—10 years.

M. Pape, piano forte maker, Paris, for a machine for boring, and cutting veneer, and also for turning the feet of pianos, and furniture —10 years.

Andre Millet, Paris, builder, for an apparatus adapted to the tops of chimney pots, to prevent the smoke from beating down by high winds—5 years.

Albert Sakoski, Paris, boot and shoe-maker, for the invention of an elastic water-proof shoe with steel soles—10 years.

Charles Dollfus, of Cernay, for a machine for carving circles and other figures upon the rollers for printing cotton—5 years.

Jean Antoine Collombet, Bordeaux, writing master, for improvements upon the American method—5 years.

Philibert Maillot, Lyons, for the invention of a malleable and ductile metal, called maillechort—5 years.

Pierre Fusz, of Insming, Chateau Salins, for a machine, called the enrayure a levier, for locking the wheels of carriages, without requiring the coachman or postillion to alight—10 years.

Migeon, forge master, at Belfort, for a new invented pair of bellows—15 years.

Jean Henri Pape, instrument maker, Paris, for a new invented sounding board, and a superior arrangement of the hammers—10 years.

Wilhelm Scheinlein, engineer, of Langenfield, Bavaria, for a surgical instrument, called the Lithon-triptor, for breaking the stone in the bladder, and reducing it to powder—5 years.

Jean Christophe Gotten, mechanic, Paris, for a mechanical hydraulic lamp—15 years.

Louis Nicolas Debergue, Paris, for a loom for weaving flax, cotton, silk or wool—15 years.

Antoine Perpigna, Paris, for a new invented filtering stone—10 years.

Francois Antoine Sautermeister, instrument maker, Lyon, for an instrument with eleven keys, called the Nouvel ophicleide.

Charles Rule, Paris, for a process for extracting gas from all oily, pitchy, bituminous, and other substances, with great economy, security and despatch—15 years.

M. Lecarriere, gas apparatus manufacturer, Paris, for a machine for regulating the emission of the gas—5 years.

Gabriel Francois Bardel, Paris, for a method of making steel—15 years.

Auguste Sevene, Paris, for a machine for clipping cloths and stuffs —15 years.

Pierre Larguier, St. Rouan, Notary, for a new method of applying steam in silk mills, for heating the water—5 years.

M. Lepine, Paris, for a new invented lamp, with lasting wicks—5 years.

Pierre Chaussy, of Avignon, for a press for extracting olive oil, and the juice of grapes, &c.—5 years.

Jacques Etienne Morcau, steel chain maker, Paris, for a machine for making clasps—5 years.

Benjamin Devaux, Paris, for an invention for making paper and paste-board of hemp—10 years.

Andre Delcourt, Paris, for an improved machine, called a Linourges, for spinning flax, and preserving it from the damp—10 years.

Mathias Levis Lauzenberg, currier, of Strasbourg, for a machine for separating sheep, goat, and calf skins, in halves—10 years.

M. Poirot de Valcourt, Paris, for a delving machine—15 years.

William Wilmot Hall, of Baltimore, for a method of using the warm air, and other heated matters, to act upon a piston—15 years.

Silvestre Vanhoorick, Inspector General of the studs, at Strasbourg, for a carriage, which by means of a moveable shaft, cannot be overturned—10 years.

Alexander and Robert Carswell, of Greensworth, Scotland, for improvements in vessels, set in motion by machinery, acting upon the water—15 years.

Pierre Joseph Paret, of Montpellier, mechanician, for a weighing machine—15 years.

Jacques Augustin Gandais, of Paris, plated silver manufacturer, for a steam and filtering coffee pot—5 years.

NOTICES.

Delay in Publication.—Until within a day or two, scarcely any of the European Scientific Journals, of a date later than October last, had come to hand, and several are yet missing; we have waited for the intelligence which they usually contain, and this has concurred with other circumstances, in delaying the three last numbers of the Journal, an event which we hope will not again occur.

Lithography.—The number of the *Journal des Connaissances*, for December, is just received; the subject of Lithography has been resumed in it, and will of course be continued in our next.

New Arrangement.—The property of this Journal, has, by an arrangement made with the Editor, passed into the hands of the Franklin Institute; this will make no change in the general mode of conducting the work, as the Editorship still vests in the individual to whom it has heretofore belonged; but the work will hereafter be published at the Institute. Agents, and subscribers, are therefore requested to direct their letters to the *Actuary*, at the Hall, who will transact all the business appertaining to the subscription for, and distribution of, the Journal.

Communications to the Editor, may also be directed to the Institute.